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The Quarterly

Vol. 3 April, 1910 No. 4

Forward. The fourteenth annual meeting, to be held May 17th, 18th and 19th, in Chicago, already promises to be one of the best attended in the history of the organization. A pleasant and commodious assembly-room has been placed at our disposal by the new Hotel Lasalle, which has been selected as headquarters. The official program is now in preparation and will be mailed to members as soon as it is completed. The president of the American Institute of Architects, Mr. Irving K. Pond, is to speak, and others of equal note are to contribute to the program. The Underwriters' Laboratories will, as usual, have interesting developments to exhibit.

The Chicago meetings are of especial value to that large portion of our membership which resides in the West, and the plan of holding the annual meetings alternately in Chicago and New York works out most satisfactorily. It will be noted that the meeting this year is placed a week earlier than usual. This is done to avoid conflict with the annual meetings of one or two of our active members who commonly choose the last week in May.

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The Executive Committee. The Executive Committee met on February sixteenth in New York for the transaction of routine business and to make suitable preparation for the annual meeting. The following committee on program was appointed: Franklin H. Wentworth, Chairman; C. M. Goddard; W. H. Merrill. H. L. Phillips was appointed as committee on resolutions. Geo. W. Booth was appointed a member of the Committee on Hydrants and Valves, and E. P. Stover, Jr., a member of the Committee on Devices and Materials, vice J. C. Richters, resigned. The election of a successor to Henry E. Hess, resigned from Executive Committee because of change in business, was deferred until the annual meeting. The next meeting of the committee will be held in Chicago immediately preceding the annual meeting.

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Membership Gains. The circular sent out on January fifteenth, by Chairman Phillips of the Executive Committee, urging members to co-operate in increasing the membership of the Association, while it did not perhaps meet with quite the response hoped for by the executives, was yet eminently worth while, as the number of new mem-

bers enrolled during the last quarter shows. Between January first and March thirty-first the gains in the three classes were as follows: Active, 5; Associate, 69; Subscribing, 40. The names of all members will, as usual, be contained in the program of the annual meeting and the annual directory of the Association will issue as soon thereafter as the executives meet to appoint the new committees. Usually the occasion of the annual meeting is one for a generous influx of new members and this year's meeting at Chicago may prove no exception.

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Flour Mills. An excellent article on flour mills is contributed to this issue by our active member the Ohio Inspection Bureau. A recent issue of the *American Miller* dealt at some length with the fire losses sustained by the flour mill owners of this country during the year 1909. Of the mills destroyed by fire last year, the larger ones carried insurance up to seventy-five per cent of their value, many of the smaller plants were insured up to forty per cent, while ten mills that were burned carried no insurance at all, owing, no doubt, to the fact that the owners of these plants could obtain insurance only at prohibitive rates, because of the extra-hazardous nature of the risk. Commenting upon this latter fact, the journal above referred to says it should have moved the owners of the mills in question to "immediate activity toward better and safer conditions."

Discussing the fire-fighting equipment of the mills destroyed and the causes of the fires, the article from which we quote states that practically half of the mills had no apparatus of any sort at hand, while about a third of them were equipped simply with water barrels and hose. Twelve mills reported hand extinguishers and chemicals of one sort or another. In but four instances did the mills that were burned have what could be termed "full equipment" for fire fighting, and in each of these cases other elements, such as high winds, explosions and general conflagrations rendered total destruction of the plant almost a certainty. The most commonly reported place of origin of the fires was the engine room, with live cinders and defective flues as the principal causes. Next in order came the roof and the attic, where the fires were started, as a general thing, by locomotive sparks or over-heated elevator heads. About one-half the fires reported in flour mills last year were listed as from "cause unknown." Hot boxes on machines or in elevator heads caused nine fires; three were due to incendiarism, while locomotive sparks set fire to three mills.

September was the month of big fires in flour mills; three plants were destroyed during that period, entailing a loss of over six hundred thousand dollars. About seventy-five per cent of the fires occurred between the hours of 8 p. m. and 6 a. m. and in only one-third of the instances was the mill in operation. In view of this fact, it would seem unnecessary to direct the attention of mill owners to the importance of having their premises patrolled by an efficient watchman at night, should the mill not be in operation. This is a point that fire protectionists should strongly

impress upon all mill-owners, as there is but little doubt that a very large percentage of the night fires in flouring mill plants would have been discovered in time to prevent serious loss had a watchman been on duty on the premises. In by far too many instances is the statement made that "the fire started when no one was around."

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Fire Resisting if not Fireproof. Our very interesting report in the section devoted to fires in fireproofed buildings, on a recent fire in a modern apartment house, contains matter for reflection. This building was extensively advertised to be fireproof in all details and it likely was, so far as the materials that entered into its construction were concerned, but the results do not confirm this statement. A building in which a fire can burn for several hours and do an estimated damage of $300,000, cannot be classed as strictly fire-resistant. There is really no fireproof building, and this has been demonstrated time and again where such structures have been destroyed the same as others, where only building material of a general kind was used. In the case of the Alwyn Court apartments it may be said that the portion of it attacked showed considerable fire-resistant properties, which were discernible after the fire had been extinguished. The stubbornness of the flames, for the most part, must be attributed to the contents of the apartments. No place can be free from serious fire that contains large quantities of inflammable materials. As furniture and other household goods are of this nature it is safe to say that once a fire obtains a good hold on them, there will be considerable, if not a total loss. This is what happened in the Alwyn Court apartments, and it might have been confined to the floor on which it originated had not the places of egress been opened which allowed the flames to spread to the other two floors. In commenting on this fire the New York Times said:

"The burning of the upper floors of a new and costly apartment house, in the construction of which, presumably, every device known to modern building science to secure safety was employed, has undoubtedly shocked the multitude of flat dwellers. The house, which assumed for a few minutes in the eyes of thousands of onlookers Friday night the appearance of a huge torch, ought to have been as well protected against fire as any dwelling in New York. Yet a fire which endangered human life swept through its upper stories with amazing swiftness. The natural inference would be that any of the new, professedly fireproof dwellings for many families, in which the rental for an apartment sometimes exceeds that asked for a private mansion in an expensive neighborhood, is likely to burn. But the fact is that fires in such buildings are uncommon, and when they occur are generally extinguished with little trouble and with no alarm whatever to the occupants. Investigation will doubtless reveal some gross carelessness on the part of employees of Alwyn Court or workmen from the outside. The fire did not last long, but it spread quickly at first and the flames were more alarming than the smoke, which might of itself cause disaster in a building of the nearest approach to fireproof construction ingenuity could devise. An ordinary building thus threatened could scarcely be saved by the firemen summoned by three alarms. Probably the damage caused by this fire can soon be repaired. It will be to the interest of the owners of the building to lay before the public every fact touching on the fire's origin and spread. When the facts are all known it is likely that the alarm aroused among dwellers in similar structures will be allayed."

The walls and interior finish of the rooms in which the fire occurred, showed good fire-resistant qualities and there is much encouragement in the fact that they were little injured by the fierce heat that prevailed while their contents were burning like a furnace. It will be recalled that when a fire broke out in the Home Life building a few years ago, the fire was fought and controlled on the seventh and eighth floors and that the occupants of other parts of the building were able to continue their business without interruption. This was classed as a fireproof office building and it was probably as much "fireproof" as the Alwyn Court apartments. Both of these fires were fought nearly one hundred feet from the ground, and considering the disadvantages under which the firemen worked in each case, the result must be considered comparatively satisfactory from a fire-resistant standpoint. Had the structures been constructed in the ordinary way without the use of fireproof construction material, there would be little use in risking lives to stop the fires at such a height. These two buildings afford an opportunity to study the merits of modern first-class construction and it must certainly be said that the tests they withstood prove that great progress has been made along that line. Moreover, the fact is established that firemen may reach upper floors in skyscraper structures and work there with little fear of walls collapsing, until the fire reaches a heat sufficient to warp the steel framework.

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Concrete as a Heat Insulator. Chairman Cairns of the Committee on Fireproof construction sends us an interesting note on the transition of heat through a concrete floor of a building in Cleveland, Ohio. In a reinforced concrete building having floors eight inches thick with no wood surface a battery of boilers was located in the basement. The metal breeching, which is about three feet square in the cross section and unprotected by any insulation, came only about six inches below the under side of the floor above. This floor became sufficiently hot to set fire to some baled paper stored in the first story on two different occasions. A later examination developed the fact that the floor was hot enough to ignite a match laid upon it.

While it is well known that concrete is an excellent heat insulator, this condition illustrates that it has some limitations and will take up and hold heat applied at short range even in a fireproof building. A much greater space than six inches should be required between any floor or other member and anything so hot as a boiler flue.

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The Fire Record. The fire record of oilcloth and linoleum works, given in this issue, is interesting principally because the conclusions to be drawn from it are so indisputable. It is obvious that static electricity igniting inflammable vapors is the principal fire cause to be looked after in such properties and that therefore the utmost care should be taken in "grounding" the coating-knives, which are prone to accumulate static discharges in passing over the surface of the oilcloth. The presence

of the vapors renders the possible spark a constant menace. It is also obvious that drying-racks almost invariably offer obstruction to the satisfactory operation of automatic sprinklers.

Another point is that the flash fires occurring in such plants open so large a number of sprinklers as frequently to deplete the primary water supply before the secondary supply can be drawn upon. A very generous primary supply is obviously necessary, and the sprinklers should be carefully disposed to overcome as far as possible the obstructions to distribution.

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Following our custom, we are giving in this issue, which completes volume III, our usual carefully compiled statistics of unsatisfactory sprinkler fires. This brings this feature up to date and includes the total number of such fires in our records. These tables require no editorial interpretation, but attention is directed to those giving the efficiency of alarm service, the effect of sprinklers by class of occupancy and the classification of unsatisfactory sprinkler fires by occupancies. To those directly interested in automatic sprinkler protection these statistics are illuminating and should be of great value.

The Publicity Campaign.

Activity of the Speakers' Bureau.

The publicity work during the last quarter has been confined almost wholly to public speaking, for which there is a rapidly growing demand and which is invariably given extended notice by the press. Mr. William H. Merrill's speaking tour of the cities of Kansas City, Omaha and Denver, was the first experiment of its kind and was most gratifyingly successful. It must be admitted that in this generous service donated by the manager of the Laboratories, the Association had the benefit in its experiment of an unusually forceful and impressive personality. Had we a dozen speakers like Mr. Merrill to let loose in the states we could easily take the nation by its four corners and shake it out of its careless habits. But a point outside of the exceptional speaker we were able to furnish for this tour, and a point equally interesting to us, is that the cities themselves responded so quickly and interestedly to a consideration of the fire waste. In Kansas City the commercial club received Mr. Merrill and invited to the meeting the fire warden, the fire chief, representatives of the city government, and the insurance fraternity. At Omaha, the next evening, our speaker was given an exceptional opportunity by the commercial club and the credit men's association who were entertaining at a banquet at Hotel Rome the federation of Nebraska retailers. The audience was about 400 and comprised influential men from all over the state. The

manner in which Mr. Merrill's message was received clearly indicates that both the credit men and the retailers are keenly alive to our work. We are unable to reproduce the speaker's address, which was largely extemporaneous, but the following paragraphs cut from a local report are sufficiently indicative of its trenchant character.

"Waste and extravagance are important factors in the increased cost of living which is now a matter of general complaint. The epitome of recklessness in expenditure is supposed to be represented by the person who uses bills of large denominations with which to light his cigars. This individual employs this means to advertise the fact that he has money to burn. Our national fire waste seems to classify the people as a whole with this individual. Is it pleasant to conceive of him as the typical American?

In the economic scale it is unimportant whether or not the burning of half a dozen grain elevators affects the price of bread, or the destruction of a number of cold storage plants affects the prices of other food products. It is the destruction which counts, whether it be wheat, beef, dry goods or other values. For that which the individual destroys by fire under insurance taxation the nation must pay."

Denver took hold of the matter in true Western fashion. Mr. D. W. Canfield, one of our valued members, had taken the initiative and had planned for a joint meeting of several of the commercial organizations. In order to take advantage of the exceptional opportunity afforded by the banquet at Omaha, however, Mr. Merrill put forward his trip and landed in Denver a week before he was planned for. That this emergency did not in any manner stagger the Denverites is obvious from the contents of a private letter to the Secretary which exhibits so well the Denver spirit and is so characteristic of the Laboratories' manager himself that we hope we may be pardoned for quoting from it:—

"At Denver the joint meeting of the various organizations could not be arranged before Thursday of the next week, and as I felt I could not spare the time to stay over, much as I would have liked to have done so, Canfield and the rest cut themselves loose to show what Denver could do in such an emergency. They started off with a very elaborate luncheon at one of the hotels on Friday noon, inviting a number of the prominent citizens, having about twenty small tables filled in addition to the speakers' table. Following my remarks on this occasion, they turned in and hired a hall for Saturday evening, sent out messages, put notices in the newspapers, and succeeded in furnishing an audience which was really the best I met anywhere on the trip. For attentive interest the Denverites excelled anything I have met up to the present time. I spoke to them for exactly two hours and five minutes, and not a man left the room and no one went to sleep. Moreover, they did not seem to experience any ill effects, for at the conclusion they crowded around me and kept me answering questions for another half hour."

It would be a callous nature and one not having the cause at heart who could fail to respond to the enthusiasm manifested by the speaker and his audience alike in the Rocky Mountain city. Mr. Merrill concludes his letter as follows:—

"The whole journey was, of course, a series of one-night stands, and I look upon it more or less as an experiment. It is early to predict practical results, but the whole impression I got in the western country was that the proper presentation of the subject of the fire waste and the work of the National Fire Protection Association is of decided interest, and considered of real importance by these people. They are keenly alive to the N. F. P. A. work, many of them quite familiar with it, and all of them are hearty supporters of the Laboratories. The unlabeled window or extinguisher is the exception in all of these cities, even the older structures being equipped with the newer and labeled first-aid appliances."

It is indisputable that the spoken word possesses an influence immeasureably superior to the written word, owing to the element of personality which may accompany it, and as in such agitation as ours, we secure both by a suitable report of the meetings, our work along this rapidly expanding line is doubly effective.

Mr. Louis S. Amonson, of Philadelphia, made two notable contributions to this department of our work, in the month of February, by his speech on The Red Plague at the annual meeting of the Illinois State Association of Local Fire Insurance Agents at Alton, Ill., and by his address, The Crime of Fire, at a banquet of insurance men in Cleveland, Ohio, both of which occasions were well reported in the daily and weekly press. Mr. Amonson does not hesitate to place sufficient emphasis upon the nature of the fire waste. Among other good things he said at Cleveland:—

"Every fire is a crime, because every fire is due to one of three crimes—the crime of ignorance—the man don't know that certain conditions will burn his place; the crime of carelessness—the man don't care whether his place burns or not; the crime of dishonesty—the man wants to have his place burn and cash in at the expense of the American people. Every dollar that goes up in smoke makes Uncle Sam just so much poorer. A loss by fire is a permanent loss that can never be made good while the world stands. In a million years you can never restore a single house that has been burned—the good muscle that went into the building of that house with the strokes of the hammer; the labor of the man who put the slate on the roof; the labor of the man who painted the wood; all is destroyed for time and eternity."

Mr. Arthur Hawxhurst, of Marshall Field & Co, Chicago, another member who frequently scores heavily in our agitation, spoke before The Fire Insurance Club of Chicago in March upon fire insurance as a prerequisite to credit, and in the course of his talk paid this high tribute to the business of fire insurance:—

"Credit and fire insurance, especially, must always go hand in hand, for credit cannot be safely granted, or business now extensively carried on without insurance. This one fact alone should place it high among the valued things in commercial life, for without fire insurance what would become of business? What would become of you and I without it if the places of our livelihood as well as our homes were burnt over our heads, and yet what business is subjected to the rebuffs of the general public and those who legislate for it as is insurance? Overtaxed by every state, knocked around representative halls and senate chambers, abused and robbed by many beneficiaries of existence, nailed to the cross of many men's unfair criticisms and grievances, and yet, like a redeemer, not looking for the plaudits of this world, insurance goes on fulfilling its mission and saving from misery and want the children of men. A company, like an apostle, falls by the wayside now and then, after a noble effort to do its share, but another takes its place and the work and protection continue.

"Think of this and look the world over, and find, if you can, another business that is doing half as much for man's benefit, and then feel a just pride in the business in which you are engaged. The owners of no other industry would furnish from their private purse millions upon millions of gold because a city was destroyed and its people were in dire distress, having only its ashes to tell of a past greatness; but the owners of fire insurance companies have done this—they did it for San Francisco, and in return they were not even given credit for a magnificent fairness to do not only their own full share, but more than that; to meet every possible claim against them, preserving thereby the credit of a great metropolis fallen into dust, and also saving those in other lands and in every part of our own land from loss of value of property shipped on credit ere the conflagration came."

Mr. W. H. Blood, Jr., of Boston, associate member and representative of our active member the National Electric Light Association, spoke in March at the first annual convention of the New England section of that body. Mr. Blood's speech was unusually effective because it was prepared especially for the central-station men who were assembled to hear it. The following paragraphs indicate the directness and force of the address:—

"The monopolistic position which a public service corporation holds carries with it the obligation of furnishing continuous service.

"More important, therefore, than paying for the loss occasioned by the fire is preventing the destruction. The aim of the manager should be so to construct and so to operate that his undertaking shall be free from fire. If the building is improperly constructed, even the best of management cannot fully compensate for faulty construction; on the other hand, with perfect construction, bad management may make the risk a poor one. Many operators do not fully realize how serious a matter a fire is. The fact that the property is insured, and that the loss is made good by the insurance company, seems to satisfy many; but does this cash payment for your station make good the diminution in income, or does it in any way return to you the confidence which the public loses when a plant shuts down on account of a fire? Although your building may be restored, without expense to you, after six or eight months, what has been the effect upon your earnings and upon the dividends of the company meanwhile? Does even a so-called 'unavoidable' fire absolve you from furnishing continuous service? Do you suppose that the manager of a theater, for instance, cares why he does not get the current with which to light his building when he has a performance scheduled, or do you think it satisfies the man who lives three or four miles out in the country to know that cars do not run because the power house which generates the current for running them has been burned? What both of these men, the manager of the theater and the street car patron, want and what they are entitled to, is continuity of service.

"How shall this continuity of service be secured? First, by building so that a fire will be unlikely. Second, by so protecting the property that if a fire is started it may be localized or extinguished before serious damage is done. Third, by so looking after the details of management that the starting of a fire may be minimized.

"Most fires are preventable, and start from either carelessness or lack of attention to details. Ordinary foresight and systematic and careful inspections at comparatively little expense should remove most of the causes of fire. The accumulation of shop sweepings, rubbish, etc., is a prolific source of the starting of fires. The throwing of oily waste upon the floor in dark corners or in wooden boxes is almost criminal. Metal cans are ordinarily provided for it, but through lack of inspection often fall into disuse. Sand and water pails are generally furnished with almost every electric light station, but oftentimes the sand pail is turned into a cuspidor and the water pail is used in place of a washbowl, or, on account of lack of attention, is allowed to dry up. Fire hose should be kept for emergencies, and should not be used for washing the manager's automobile or for sprinkling the grass. Chemical extinguishers are not to be set upon shelves as ornaments, but should be kept charged and in working order for immediate use. An automatic fire door cutting off the boiler-room from the generator-room is a valuable adjunct, but if barrels, crossarms or coal are piled up against it the automatic feature is removed, and it becomes worse than useless. A basement in an electric light plant is always a dangerous thing, but when it is used as a place in which to unpack barrels or for the storage of arc light globes in open tierces filled with straw or hay, it becomes a particularly bad menace. The oily overalls of machinists and others are most undesirable things to have stored away in dark, warm corners, and the careful manager either provides metal lockers or at least has the overalls hung away from the woodwork, and in readily accessible places. A plant which is oily and dirty brings about a general shiftless condition throughout, and a careful inspector can almost always tell as soon as he steps inside an electric light plant whether or not the risk is a good one.

"For plants of large size fire drills are desirable, and for the smaller plants it is essential for every man in them to remember where the fire-alarm key is kept, to know the location of gate valves and fire hose, and to realize that a pail of water or

bucket of sand used when the fire first breaks out is better than many barrels of water ten minutes later.

"The fire underwriters realize that the designing and constructing engineer cannot know all kinds of businesses, and that any assistance which they can give in outlining standards of construction will be appreciated. For this reason they have prepared, at considerable expense and trouble, specifications on various forms of construction, and pamphlets describing these may be obtained upon application. They have a complete building code, which they recommend, an interesting pamphlet on the construction of standard car houses, another one dealing with fire doors and shutters, another on fire pumps, their constructon and installation, another on hose, one on water pipes, and a very complete one describing the installation of automatic sprinklers. Besides these there is a pamphlet with which almost all of you are probably familiar, called the "National Electrical Code," which deals with electrical wiring installations and electrical fittings.

"Most of these specifications were prepared by the National Fire Protection Association, but have been endorsed and adopted by the National Board of Fire Underwriters. The National Fire Protection Association is, by the way, an organization worthy of special commendation. Its objects are 'to promote the science and improve the methods of fire protection and prevention, to obtain and circulate information on this subject and secure co-operation of its members in establishing proper safeguards against loss of life and property by fire.' It has no ulterior motive; it is simply striving to reduce the great waste by fires. The publicity work which it is doing is of inestimable value."

Mr. Blood concluded his address with a convincing array of statistics of the fire waste and an earnest appreciation of the virtue of fire-resisting building construction.

The secretary continues his personal speaking campaign as the exigencies of his executive and editorial duties permit. He has made a half-dozen speeches in New England during the last quarter, beside making two trips to Ohio: one to Columbus, to address the annual meeting of our active member the Ohio State Fire Prevention Association, the other to Toledo to speak at the banquet of the credit men, the Ohio branch of the National Association of Credit Men, an active member which in many directions is rendering the cause exceptional service.

Although the speaking campaign has represented the principal part of the publicity work of the quarter, the written word has not been wholly neglected. Mr. William B. Goodwin., of Columbus, Ohio, wrote for local publication a most convincing article on "the Necessity of a Building Code," with especial reference to the city of Dayton. Mr. Henry L. Phillips, of Hartford, at request of the board of trade of Worcester, Mass., prepared an interesting monograph on the protection of department stores, and the secretary put an illustrated article on "Factories and their Fire Protection," containing a special message to architects and builders, into the March number of the Architectural Record.

The publicity campaign promises to realize all that President Goddard foresaw for it. Beginning with the issuance of press bulletins during his first year as president, the work has expanded during his second administration until we are already sometimes embarrassed to furnish

speakers to all the organizations that are clamoring for them. The National Association of Credit Men, perhaps the most directly influential of our active members, is ready and anxious to provide occasions for our speakers, on any phase of our agitation, before the principal commercial bodies of all the cities of the nation. From the contemplation of this avenue of work alone, it is obvious that the activities and service of our Association must eventually make it a very considerable influence in the economic life of the nation.

Publicity Bureau Bulletins.

Note.—By recommendation of the Executive Committee that the general membership be brought in touch with the Publicity work of the Association there are printed below sample bulletins which have been transmitted to N. F. P. A. correspondents for publication in local newspapers. Members and correspondents are at liberty to quote from these articles, or reprint the same entire, without reference to the Quarterly.—Editor.

Bulletin No. 6. The Fire Bug.

The stupendous proportion of the destruction of property by fire in the United States during the last decade has stimulated investigation into its various causes, among the most interesting and elusive of which is the "fire bug"—the man or woman who for one reason or another deliberately sets buildings afire.

The motives behind such action, leaving out mischievous children who start fires in ignorance of the possible consequences, seem to be exemplified by three classes of persons: those who burn for revenge, those who burn for insurance money, and those who burn to gratify a diseased excitement—the pyromaniacs. The man who burns for revenge is less liable to cover his tracks than the other two, the heat of anger obscuring his judgment, and rendering him liable to detection. The pyromaniac and the man who "sells out to the insurance companies" vie with one another in cunning. The former may be regarded without resentment as an irresponsible person, but the anti-social character of the latter is manifest. He not only means to get by dishonesty the money his neighbors are paying in insurance premiums for their common protection, but in the event of the fire spreading beyond his own premises he inflicts grievous personal loss upon them as well. It is obvious that the criminal of this character is of all others the hardest to convict. He usually works entirely without accomplices, is often one who bears otherwise a conventionally good reputation, and the evidence against him is generally wholly circumstantial.

The State Fire Marshal of Ohio, the most populous of the states

having such a functionary, compares the fire bug with the burglar in the following interesting fashion:—

"The burglar must gain admittance by force, and often has tools which may be found in the place, or on his person, and used as evidence, while the owner who burns has an easy means of access to the premises, and the instruments of his crime go up in smoke. The burglar may be found 'with the goods'; the incendiary is loaded with no plunder which has to be concealed or sold. The burglar has incomplete knowledge of his surroundings and circumstances, but the man who burns his own as a 'business transaction' with an insurance company can select a safe place, and a propitious moment for his venture. To prove an alibi the burglar must suborn perjury, but the incendiary can time the starting of a destroying fire so that he can prove an alibi by true testimony."

In spite of these obvious comparative difficulties it transpires that in the states having a fire marshal's office and its detectives the conviction of fire bugs is a comparatively easy task. In Ohio there have been more convictions for incendiarism during the two and one-half years of the existence of the fire marshal's department, than in the hundred years preceding its creation. This would seem to indicate the necessity of such a department if the fire bug is to be properly looked after. The activity of county officers is so divided that they cannot give the attention necessary to tracing and convicting such criminals. Fire marshal laws usually provide that the cause, origin and circumstances of every fire in the state which damages property shall be investigated and reported to the fire marshal. The most important duty of the latter is the securing of evidence for the conviction of incendiaries, and placing it in the hands of the prosecuting attorney of the county in which the crime is committed, officers of the department who may have gathered the facts being present at the trial as witnesses. Perhaps the most important result of successful convictions by the department is their deterrent effect; the knowledge that incendiaries are quickly pursued, and usually punished operating to diminish the number of such crimes.

Nine of the states now have fire marshal departments, and in five the commissioner of insurance has the powers of a fire marshal.

As a manifestation of the quickening interest in this matter throughout the country, however, it is noted that bills for the creation of such a department are under consideration by the legislatures now in session in eighteen of the states.

Bulletin No. 7. Fire Danger and Children.

An interesting bill relative to the instruction of children in the public schools in the danger, chemistry and prevenion of fire is now under consideration by a committee of the Massachusetts legislature. So far as can be learned, Massachusetts is the only state in the Union asking for such legislation, with the exception of Ohio, which already has such a law. The burning of the public school at Collingwood, and the frightful loss of child life in that fire, spurred the Ohio legislature to a consideration of the question which Massachusetts seems to be taking up without any special holocaust to point the need of it.

The Ohio law, and the Massachusetts bill following it, has more in mind than the safety of the children in the schools. The object is not merely the compelling of precautionary measures of fire drill and rapid dismissals to guard against panics, although these features are adequately covered and the demand made that while schools are in session all doors of exit shall be kept unlocked during school hours. Most schools already follow these practices in the absence of any legislation. The radical portion of the law in question is the provision for the compulsory education of the children, by the regular teachers, in fire dangers outside and in their homes as well as inside the school building.

The novel direction of this legislation became at once apparent to the framers of the Ohio law when they were confronted by the fact that there were no text-books whatever on the subject of a character adapted to school instruction. They were brought to see that in spite of the enormous American fire waste of $250,000,000 per year, and the lamentable number of deaths by fire, many of which were set through the ignorance of children, no single step had apparently been taken to educate the young of America in this most important matter. The careless use and abuse of matches, the hazards of the open fireplace or the common stove, the dangers of kerosene lamps, live coals in ash-heaps, oily rags, and the hundred other common causes of fire—instruction in all these points had been left wholly to the chance knowledge and intelligence of the parent; which meant that the average child had been taught nothing whatever about them.

In the Ohio law was therefore necessarily incorporated a clause directing the state fire marshal to prepare a book of instruction arranged in chapters or lessons in a number sufficient to provide a different chapter or lesson for each week of the school year. The books were to be published at the expense of the state under the direction of the school commissioner and distributed in quantities sufficient to supply each teacher with a copy, the latter being instructed to teach at least one lesson per week.

In accordance with the provisions of the law, the fire marshal of Ohio prepared such a text-book, which is now in use in the public schools, and is of a large secondary value in the education of the teachers themselves, there being naturally nothing in their normal school or college courses to instruct them. It was found advisable in Ohio to publish two books covering the same ground; one of them being an adaptation for the primary grades. It is reported that the pupils find the fire-hazard lessons very interesting, particularly where physical illustrations are used by the teachers. Of the value of such instruction there can be but one opinion, and Ohio has taken a notable lead of the other states in providing it.

(These bulletins as furnished to special correspondents are in the form of galley proofs.)

Unburnable Homes.

Habits of mind are infinitely more tyrannous than habits of body. They make for the majority of men a mental atmosphere out of which they can no more rise than out of the physical atmosphere. The human masses once really under way in a given direction, either of thought or action, continue in such direction until they collide with facts sufficiently momentous to compel a radical change.

Transition periods are periods of readjustment; the readjustment of mental habits to obvious facts.

We are now in America at the beginning of such a period in our domestic architecture. On one hand we observe the continuance of the old mental habits in those architects and builders who are still planning and constructing wooden fire-traps for human habitation. Many such will go on in their unenlightenment until even the man in the street hoots at their handiwork. There are always some who are last in everything.

On the other hand we see the new intelligence at work in those often fascinating plans for small and convenient brick, concrete and tile houses which are making their way into the architectural magazines. These are the signs of the new era. Horror at the frightful American fire-waste, and the agitation regarding it, at first a mere property consideration, is slowly producing a new mental attitude. Men may soon come to see that it is inhuman to house defenceless women and children in burnable structures; and out of this clearer vision will call a halt to the erection of those hideous three and four story wooden flat buildings huddled together in many of our factory towns, awaiting almost certain holocaust. That this sort of inhumanity is yet wholly unconscious is proven by the fact that the men who build wooden tenements for the working class are the ones most likely to build wooden

Artistic Small Brick and Tile House.—Squires & Wynkoop, Architects.

Courtesy of *Brick*.

houses to cover their own families. The fault is that of an intelligence clouded by conventional habit of mind. As soon as the value of an unburnable home forces itself upon the common consciousness we will wonder how we ever so long persisted in building fire traps of wood.

The present difficulty is that architects and builders have not yet really given thought to this important matter. Expensive residences have been constructed of the burned clays and concrete, but no one has seemed to think that little houses might be made of anything but wood. That always interesting American, Mr. Thomas A. Edison, has stimulated thought in such direction, however, by his enthusiasm for the "poured" house.

The *Cement World* in a recent illustrated article has this to say of Mr. Edison's achievements:—

> He has produced a mixture of a consistency almost like water, which holds the stone or aggregates in suspension, allows the mixture to flow freely to all parts of the molds, and secures a uniform distribution of the aggregates throughout the mass. The molds are adapted to variations of arrangement, thus making it possible to change the style of houses with the same set of molds. With five or six sets of molds, therefore, a wide variety of style is possible. The time necessary for the pouring of the liquid, he says, will be only six hours. Four days after the pouring the dismantling can be done. Six more days are allowed for the hardening of the concrete. The inventor thus makes fourteen days as the time necessary for the completion of a house. This time may be reduced under specially favorable weather conditions. It is estimated that with six sets of molds 144 houses can be built in a year. As the same forms are used indefinitely, the cost is reduced to a minimum. The fact has been absolutely demonstrated by experiment, as proved by specimens in the laboratory and by actual and exhaustive tests, that a mixture is produced that has all the characteristics of a liquid, flows readily and fills all interstices and openings, and that during this flow the heavier aggregates can be held in suspension so that they are distributed evenly throughout the mass. A complete set of molds will cost approximately $25,000, while the necessary plant will cost $15,000 more. Successful operation will require six sets of molds to keep the men and the machinery constantly employed. While hitches may occur and unforeseen difficulties may arise, it must be the conviction of any man who views the specimens of poured work in the laboratory —specimens in which the aggregate was held in suspension while being poured—that the poured house is a fact and not a dream.

While making due allowance for possible superficial enthusiasms, it is surely not too much to expect that before long American intelligence will evolve methods of building small houses of concrete that shall be sanitary, convenient, durable and beautiful, and which will finally abolish the danger of conflagration which every city house-owner has now cause to fear. The constituents of concrete are not only unlimited in quantity, but they are widely distributed, so as to be cheaply procurable in every section of the country, and when properly made it seems to be not only the equal, but in many respects the superior, of the very best building stone. Moreover, it is useful in a score of ways where stone and brick cannot be economically employed. Sand and rock or gravel are present in every state in the Union in inexhaustible quantities, and the materials for the manufacture of cement are only slightly less widely distributed and plentiful. So far as the supply is concerned and likewise the value of concrete as a building material, its position as a competitor of stone or as a supplement to stone in building operations is in most instances unassailable, while the re-enforced concrete

beam and column have, in the opinion of many engineers, great advantage for certain purposes over steel framing.

Brick holds a high value among fireproof building material, and where it can be had at reasonable cost it is doubtful if it is ever displaced. There are very few sorts of stone that will stand fire, and of the various varieties marble and granite are most perishable when exposed to a considerable heat, as they crumble and are reduced to fragments.

It is obvious that new and suitable designs will require to be worked out for the small concrete house to make it wholly satisfactory architecturally. Architectural designs have evolved about the stone and brick house that are unsuitable for those of concrete construction. If the builders

Tile House with Cement Facing.

Courtesy of *Brick*.

in concrete attempt to imitate the beautiful effects that are peculiar to burned clay, the result will be prejudicial to concrete. Concrete forms have a beauty of their own, and should not be warped out of their natural development. The people, although long accustomed to the stone and brick architecture, will finally recognize the beauty of the concrete lines and arches, and the fascinating play of light on concrete rounded surfaces. Combinations of brick, tile and concrete may not, however, be unsatisfactory.

There is an interesting development in the vicinity of New York in terra-cotta hollow tile so long used as fireproofing in large office buildings and urban factories. This material is now made in such forms and in such variety as to be available for the house-builder. It is comparatively inexpensive and easy to handle. The form of construction usually followed calls for a facing of cement or stucco over the hollow-tile outer walls. A veneer of brick might of course do as well. As it goes into the walls and floors the terra cotta is in the form of hollow blocks. They are made of clay heated to about 1000 degrees Fahrenheit and then allowed to cool slowly. As when laid end on end they form continuous air chambers,

Tile House with Cement Facing.

Courtesy of *Brick*.

houses so constructed may be cooler in summer and warmer in winter than the ordinary house. The floors may include both terra cotta and concrete, the latter being used for the beams.

Mr. F. Squires, of the firm of Squires & Wynkoop, in a recent interview quoted in *Brick*, describes this fashion of construction :—

> First a false floor of wood is laid with spaces between the planks at regular intervals. Over the open spaces are laid the terra cotta blocks in parallel lines in the position they are to occupy permanently. When they are properly placed, the concrete mixture is poured in the openings between them. After the concrete has hardened, the hollow blocks are held in its tight grip and the floor is as solid as any floor can be.
>
> A variation of this plan in the construction of upper floors is to extend the beams downward below the lower surface of the terra cotta. Thus is created the effect of a beam ceiling of the same general style as the old-fashioned ceilings that one sees in English homes. A coating of cement makes the beams smooth, and the owner can make them any color he chooses. Of course a floor built in this way, with consideration for the room below, requires a more complex "centering" for the concrete than a floor that has both the upper and lower surfaces even.
>
> In a house that is really fireproof, not only the outside walls and floors, but also the partitions are of hollow-tile blocks. They are laid in the same way as the blocks in the outside walls, though they do not have to be so thick. Even closet walls are terra cotta. The result is that each room is protected from the one next to it. If a fire starts in one room it will be kept there until it is extinguished, for it cannot burn its way upward or downward or sideways.

If this were generally true of even the most costly modern residences it would not then be necessary for the owners of rare pictures and similar treasures to donate the same to public galleries and museums to insure their proper safeguarding against loss by fire.

There is another element of increasing importance which must aid considerably in creating a demand for the unburnable house, and that is the element of sanitation.

Model of a Sanitary Concrete House.

This model was awarded the prize Gold Medal at the late Congress on Tuberculosis, held at Washington.

Courtesy of *Cement Age*.

Among the exhibits at a recent congress on tuberculosis held in Washington was a model of a sanitary concrete house, which attracted much attention and was awarded the first gold medal. It was representative of the work of a Washington architect, Milton Dana Morrill, who has made a study of healthy housing of the industrial classes in Europe and America and is of the opinion that he who can produce a clean house at a low cost will render valuable social service. The construction planned by Mr. Morrill is comparatively easy of execution, it being part of his endeavor to work in forms which are simple and easily applied to the material used.

Through the courtesy of the *Cement Age* we are able to show a photograph of the Washington model and to give the following information regarding it:—

The entire sanitary concrete house is cast—the walls, floors and fixtures being of re-inforced concrete. The window frames are of cast-iron. Duplication is the secret of the proposed economy, as it is estimated that when sand and gravel are easily obtainable, six-room attractive houses can be built for $1,200, when once the forms are perfected and made. These forms are constructed of a standard unit type so that they are to a great degree interchangeable, and by this means houses may differ in plan and design and still be constructed over the same forms.

The possible omission of repairs and their general indestructible character make this type of buildings especially applicable to rented houses.

To thoroughly clean a room the hose is used on walls and ceilings, and the composition floors are graded to plugged tile spouts, discharging on the lawn. All corners are covered and all fixtures are bracketed from the walls which leaves no place for sheltering dust, vermin or insects. The coal is hoisted by a simple chain block attached to a swinging davit, and is dumped through a hole in the roof to a large pocket from which it feeds by gravity into the fire-box of the stove, the ashes falling into a pit and being removed from an outside door.

This stove combines in one compact fixture cooking range, house and hot water heater and gas stove.

The garbage is placed in a cast-iron chamber in the smoke flue, and after drying is dumped into the fire-box by a damper.

Fireplaces in each room have flues about smokestack forming a natural ventilation.

The ice box is arranged for use as a fresh-air closet, doing away with use of ice except in hot weather. This is also arranged to be flushed with hose.

The walls are hollow to prevent dampness, and the roof is of open cellular construction, cool in summer. An attractive feature of the house is the roof garden and sun room, forming out-of-door bedrooms, divided by use of movable screens.

Window boxes form an inexpensive and at the same time artistic decoration.

The exterior surface is of frank concrete with pebbles washed and exposed.

The time must inevitably come when, guided by a more intelligent economy both in life and property, every man constructing a home either for himself or for another, will embody in it the idea of permanence, of beauty, of cleanliness and health. We will in that day discard our stuffy hangings and unsanitary carpets, our useless bric-a-brac and other dust-collecting plunder, and work out in modern form those simple ideas of life which yet make ancient Greece the marvel of the world.

When that day comes our present daily tale of women and children fleeing, shrieking in the night, from the burning homes that should rightly be their citadel and shelter, will seem to us like a horrid dream of an unlettered and savage civilization.

The Fire Commissioner's Office.

By A. Lindback.

Fire Commissioner for Manitoba, Canada.

There is perhaps no organization on this continent more alive to the need for reducing fire losses, or which is doing more effective work to accomplish this result than the National Fire Protection Association.

As active members, it counts about seventy-five organizations distributed over the United States and Canada, and one would think that it would be only a matter of a short time when all its work would show its effect by a perceptible reduction in our fire waste. The facts are, however, that for the last ten years we have had to mark up losses out of proportion to the increase in population and property. One reason for this perhaps is the almost unprecedented prosperity which has prevailed on this continent urging the people to new achievements and making them reckless and careless and unappreciative of heavy losses. While millions were being created there has been little time or attention paid to the millions annually annihilated by fire.

The average man does not care for nor appreciate the fact that on this continent we are burning almost as much per year as we build. Even he who is burned out and has felt the inconvenience and hardship in loss of time and business, usually consoles himself when the insurance is paid, and proceeds to build another fire trap; continuing the same careless habits which caused his first fire. While this seems a rather pessimistic view of conditions, it is only in very recent years that improvements have been made by the erection and construction of more substantial and fireproof buildings, and there is no question but this happy change has been accomplished almost entirely by the activities of the underwriters in connection with the work of the National Fire Protection Association.

No one perhaps gets nearer to these facts than the Fire Commissioner in his routine work, and while the causes which are revealed by investigations of the ash-piles contain many object lessons, the paramount duty of the Fire Commissioner and Fire Marshal must always be to find means to minimize the outbreak of fires or restrict these outbreaks to a minimum amount of damage. The question, therefore, is, "what will most effectively minimize our fire losses, and how can we circumscribe the damage from the fires which do start?"

When it became necessary for me to tackle these questions, it first occured to me to ascertain if the losses by fire in other parts of the world were as serious or as large as on this continent, and I soon found that in Europe, for instance, in the older settled countries, such as England, France, Germany and the Scandinavian countries, the losses from fire proved to be so remarkably less than here, that something more than better construction had to be looked for as an explanation of these conditions.

Carefully looking into the matter, I found that the average loss on a hundred dollars of insurance was in

France, about	.06
Great Britain, about	.09
New York, about	.58
Texas, about	$ 1.10

As to the laws bearing upon fire prevention it further developed that in France every person is by law personally liable for any loss or damage caused by his own carelessness or negligence. The law assumes that a tenant is responsible to his landlord and neighbor unless he can prove that the fire started from some defect in the building or neglect on the part of the landlord, when he in turn is held responsible to tenant and to the owners of adjoining property.

When suggestions are made for similar legislation over here, we are up against the cry of "interference" with personal liberty, which infers that liberty as generally conceived is the right to do as one pleases with one's property regardless of consequences to one's neighbor.

In my opinion our costly bonfires will keep increasing until we succeed in inculcating a sense of personal responsibility either by law or by precept.

A further help to the decreasing of fire losses will be found if we can instil a proper comprehension of the actual nature of fire insurance into the mind of the general public. Insurance does not, when honest and legitimate, fully cover the loss. It can merely help to get over the immediate difficulty. In a recent instance a party bought a house for $400, and the lot on which it was built for $400, and insured the whole for $800. This manner of insurance is fraud, pure and simple, and the agent who wrote it is primarily to blame.

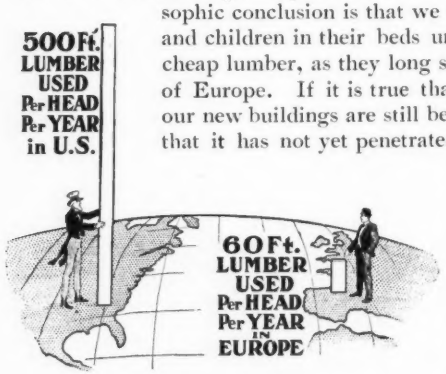
Fire insurance, as it should be understood, is best likened to the contents of a basket to which all have contributed, and from which insurance companies as the guardians are allowed to collect toll for their labors connected with such guardianship and distribution to the loser by fire; but every grab from the basket has to be replaced by the rest of us and represents annihilated values. Fire commissioners and fire marshals in their individual jurisdiction have a wide field to work in on these lines, and it is my belief that in pushing this particular line of educational work, we may eventually succeed in calling a halt to the nation's most reckless annihilation of enormous values for which there is no sane excuse.

We should endeavor to get our legislatures to enact laws which will promote a better understanding of insurance and the spreading of principles of ordinary care should be incorporated in the curriculum of our public schools, so that the growing generation may imbibe to the full extent a better understanding of these matters than the older and present generation possess.

The fire commissioner's office should not be considered as merely a detective bureau, but one of careful and continued inspection of buildings and conditions, whereby it may improve and diffuse such knowledge to the public.

Are Conflagrations Inevitable?

It is now commonly believed that all of the wooden cities of the United States must sooner or later be licked up by the devastating tongues of conflagrations. Cities of brick, stone and cement may endure,—and even this, with Baltimore in the memory, must be said with reservation—but the destruction by fire of our wooden cities is conceded to be inevitable. It would be remarkable that in the face of such fatalistic conclusions we should continue to build of wood, were it not an accepted fact of political science that financial considerations invariably determine our collective action. "Economic determinism," the modern scientists call it, and its application to the matter in hand is obvious when we consult the recent statistics of the United States government, showing the heavy preponderance of wooden buildings in the states where lumber is still comparatively cheap. The inevitable result of and commentary upon this determining factor is that the states in which there is still a supply of lumber show a *per capita* fire loss of 59 cents over the *per capita* fire loss of the treeless states. The philosophic conclusion is that we will continue to burn our women and children in their beds until we come to the end of our cheap lumber, as they long since have come in the countries of Europe. If it is true that in America over 60 per cent of our new buildings are still being erected of wood it is obvious that it has not yet penetrated our financial consciousness that permanent buildings are in the end the more profitable. Americans never did care much for human life, as the statistics of human slaughter in our mines, railroads and factories clearly show, but we have never failed to respond to the opportunity to make a dollar whenever we have discovered the way.

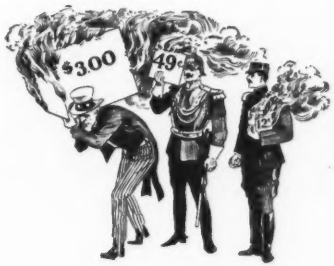


Europe has been schooled by the centuries of the economic life she has lived, to undertand that there is profit in permanent structures. We are learning it at a very considerable comparative cost per annum. The editor of the *Engineering News* in a recent address said:—

"The buildings annually consumed, if placed on lots of 65 feet frontage, would line both sides of a street extending from New York to Chicago. A person journeying along this street of desolation would pass in every 1,000 feet a ruin from which an injured person was taken. At every three-quarters of a mile in this journey he would encounter the charred remains of a human being who had been burned to death."

Such striking presentments, portraying our national folly in the form of pictures should awaken us; but they do not, because they do not show the citizen how the fire loss touches his pocket. To tell the average man

that the fire tax is $3 *per capita* has no effect either. He will not exert himself to reduce it. It is a good deal like telling him that all men must die. He accepts it mechanically as a truth which somehow applies to others, but not to him. He will not fast if you tell him that over-eating is shortening his life. He waits for some actual pain to quicken his cerebrations. If, following this example, instead of the $3 *per capita* fire tax being merged with the cost of the things he eats and drinks and wears after the manner of all indirect taxation, it could be separated from him in a lump sum during his conscious moments, the citizen would be able to realize the importance of the warning. Thus, if on a certain blue Monday in each year, a public collector should drop in upon the head of a family of five and ask for a check for $15 as his share of the cost of national carelessness, the fire tax would soon appear in its true significance as the price paid for collective stupidity. It is easier perhaps to pay this $3 *per capita* in pennies and half-pennies as we buy our supplies; but it is surely no more economical, and not half so intelligent as to enter it in our annual budget as a liability. It is a grievous burden for the men of large families to carry.



PER CAPITA FIRE LOSS.
Italy, 12 cts.: Germany, 49 cts.; United States, $3.

However insensible the mass of men may be to their gradual impoverishment by habits of waste, there is no excuse for silence or inertia on the part of those who know. Superior understanding imposes a social obligation. It behooves us, then, who are aware of the very serious economic evil of our excessive fire tax, to exert every effort to protect and preserve the common life from the effects of its own unwisdom.

It is obvious that for a considerable period of years we are to continue to build largely of wood. What then can we do to minimize the risks we take in such construction? Are periodic conflagrations really inevitable? Is there not some manner by which we may at least reduce the conflagration areas of our towns and cities, as we have reduced the large floor areas of factories?

The fact that land values are highest in the center of a city and that

MAP SHOWING BUILDING CONSTRUCTION
PETERSBURG, ILL.

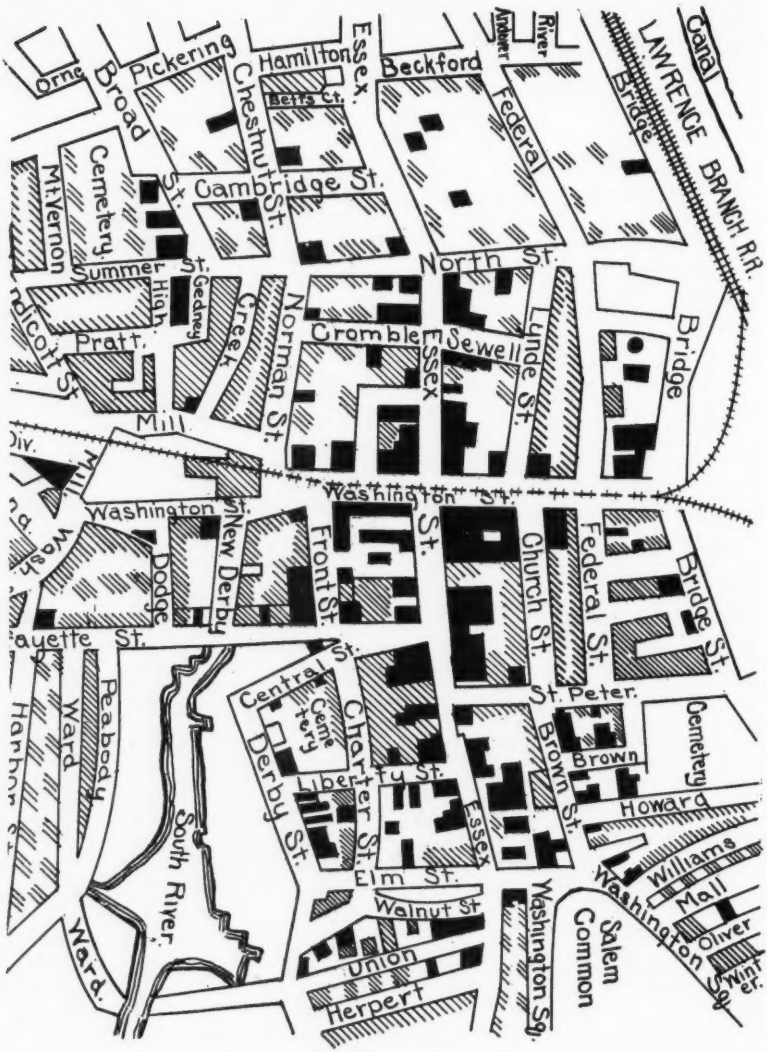
Showing value of open square as a fire stop.

such property is vested in private persons makes a lessening of the conflagration hazard by the provision of open spaces well-nigh impossible. It is not the habit of landlords to defer to the public good, and the public agitation sufficient to secure legal condemnation would meet with militant private opposition. In many of the county seats in the West this matter has been admirably, although unconsciously, provided for by placing the courthouse in the center of the town with a generous open square about it. Such towns, however, were planned in advance. Most cities and towns of the United States have grown up formlessly, the congested district moving far away from its original or logical center. To lessen the conflagration hazard in such cities the secretary of the National Fire Protection Association has evolved an idea which has been hospitably received by many newspapers and individuals who have commented upon it. Speaking recently before the Worcester, Mass., Board of Trade, he said:—

> There is a way to solve this conflagration problem:—not absolutely, but at least relatively; and Worcester might become historic by being the first American city to initiate it. You cannot be expected to tear down your city and rebuild it of fire-resisting material; or even to tear down enough buildings to allow broad streets or parkways,—by which open spaces conflagrations might be arrested. Your present City Hall park is an admirable fire-stop of this character. The cities must be protected as they stand. What then can be done by you beside furnishing water-supplies and fire departments, keeping your city free from rubbish, and prohibiting, forever and always, the shingle roof as if it were a public crime? I would suggest this plan: In the heart of nearly every city there are streets crossing at right angles, along which for a very considerable distance, are buildings of brick, stone or concrete. Looked at upon the map this shows a more or less complete Maltese cross of buildings which are not wooden, and which operate to divide the wooden-built districts into quarter sections, and which might hold a fire in any one of these sections if they were equipped to do so. These brick and stone buildings are valueless as fire-stops because their windows are of thin glass and their window-frames of wood. At Chelsea the conflagration attacked such buildings easily; breaking out the panes, consuming the frames and converting each story of these brick structures into horizontal flues full of combustible contents. Brick and stone buildings are logical and capable fire-stops if the fire can be kept out of them. If you will trace out your Maltese cross of such buildings in Worcester and equip them with metal window-frames and wired glass, you will immediately possess the equivalent of substantial fire-walls crossing at right angles in the center of your city, dividing it into four sections. By such a simple, inexpensive, but yet strategic procedure, you may be able to save your city from the destruction which now awaits only the right kind of a fire on the right kind of a night.

It would seem that by a proper agitation of the matter the property owners in every city might be induced to take the suggested precautions for their own and the public safety. The outlay in money would be negligible compared to the salutary benefits of such protection. It would be perfectly reasonable if city ordinances were drawn to compel it. Some day they may be; and to demand that every city block shall be completely equipped with automatic sprinklers as well. The entire community has a vital interest in preserving the business districts from conflagration, for there is scarcely a livelihood that may not be adversely affected by such a calamity.

The other evening while speaking before the Plymouth (Mass.) Commercial Club, Secretary Wentworth was asked how he would apply his plan of the Maltese cross to that city. Plymouth is long and narrow and



Conflagration Hazard, Salem, Mass.

The brick buildings (shown in solid black) are surrounded by hundreds of acres of wooden structures. Maltese cross plan of fire stops would involve equipment of all brick buildings along Washington and Essex streets with metal window frames and wired glass.

almost wholly wooden. Near the middle of the long strip of buildings a high hill projects toward the center, narrowing the strip to about 1,000 feet between the hill and the wharf. A street runs from the base of the hill to the water. It is called Middle street. Mr. Wentworth put his finger on the map, showing this street as the strategic point for a fire barrier. The following conversation then ensued, according to a local report:—

"You may easily see," said the speaker, "that if you were to build a high wall down Middle street you would have, with the help of the bluff, a fire-stop that would divide your conflagration district in two."

"Would not such a wall be unsightly?" asked a member.

"Yes," said Mr. Wentworth, "it would. I was speaking theoretically. But a practical suggestion is possible. Get your property holders on one side of the street to build a row of properly protected unburnable structures from the hill to the wharf."

"If the gentleman thinks that suggestion is practicable he ought to know some of the property owners on that street." (Laughter.)

The speaker joined heartily in the laugh. "I am not vouching for the public spirit of your citizens," he said. "I'm just telling you what might be done to keep a possible conflagration from sweeping Plymouth from end to end. Let the city condemn and buy one side of the street and build the non-combustible row of buildings herself."

"If the speaker will permit me," said a member, "I would like to ask to what use the city might put such property?"

"To various uses," replied Mr. Wentworth. "While driving about today, I noticed you are building three-story frame tenements in which to house your working people. This is but to intensify your conflagration dangers. Suppose the city were to build a row of three-story model brick or concrete tenements, with wired glass windows in metal frames. Then you would have your fire-stop and it would pay for its upkeep, and interest on the investment. Many modern cities are building tenements, but none perhaps with the double object of housing the workers and providing fire-stops."

There is probably no single city, whatever its topography, in which the conflagration hazard might not be reduced if local thought and application were devoted to solving the problem. Fire stops of the character indicated are however of limited value in a city whose buildings are covered with wooden shingles.

Non-combustible roofs are imperative if fire-stops are to be effective. If the burning brands carried over the fire-stops by the powerful upward currents of heated air can alight upon shingle roofs, money spent for fire-stops may be largely wasted. In their turn blazing shingles furnish these brands to set fire to other roofs. One stands in amazement before such unconsciously hazardous development as is exemplified by the city of Denver, Colo. In this city possibly 75 per cent of the dwellings are covered with wooden shingles, which are used not on the frame buildings only but on the others as well. The building code permits the erection of brick, stone and cement residences with shingle roofs, and in some portions with frame gables, the upper story in a great many cases being entirely of frame construction. Undoubtedly the building code was drafted to follow established custom, and the custom became established by the frequent imitation or especial popularity of some early architectural effect obtained by the use of wood. It is quite obvious from the elaborate character of a large number of these Denver dwellings that the wooden roofs were not adopted from considerations of expense. They were put on because the house builders wanted to put them on.

In any conflagration where the roofs are non-combustible, the fire will advance in a clearly defined line, and this line will extend as the conflagration advances. Where there are shingle roofs, however, there may be no fire line after the first half hour. By that time the conflagration is dropping flaming brands on shingle roofs half a mile in advance of its normal progress, and those who thought to save their goods, are compelled to flee for their lives from the fire all about them. After a dry spell, wooden shingles curl up at the ends and present absolute tinder to brands, or sparks from the house chimneys, even.

From every point of view the value of metal, slate or tile roofs is obvious. Tile may be too heavy for most of our flimsy structures; but slate is not, and it should be used to replace the shingle roofs of every city

Reinforced Concrete Residence That Passed Through a Fire in Winthrop, Mass.
Photo taken after repairs were made.

as rapidly as they need attention. Even the best modern types of proprietary roofings are vastly preferable to shingles, as they at least furnish a protection of the quality of good slag or gravel roofs.

With non-combustible roofs then, and the Maltese cross idea of making buildings themselves fire stops, we might dispute the assertion that conflagrations are inevitable. It is true there seem to be at times combinations of the elements which are irresistible; but if we will really exert ourselves to grapple with the conflagration hazard as it now so glaringly presents itself, it is indisputable that with a relatively small outlay of money we might so reduce the fire tax as to relieve in this respect the frightful economic burden under which the people are beginning to stagger.

The Fire Hazards of Flour Mills.

Note.—This article is a re-arrangement of an illustrated paper on Flour Mills and Grain Elevators which was written for the instruction and guidance of young inspectors in the Ohio Inspection Bureau, and its contents, therefore, are predicated on milling conditions as they exist in the Middle States, no attempt being made to give the subject a universal treatment in this paper.

Historical.

"Bread is the Staff of Life" is an aphorism dinned in the ears of mortal man from the time he forsakes a lacteal diet until he sinks back into the restful arms of Mother Earth. With the ordinary man it is a grave problem how to earn that bread, but to the miller and his host of helpers from the farmer to the grain broker there is always the big additional problem of providing the flour.

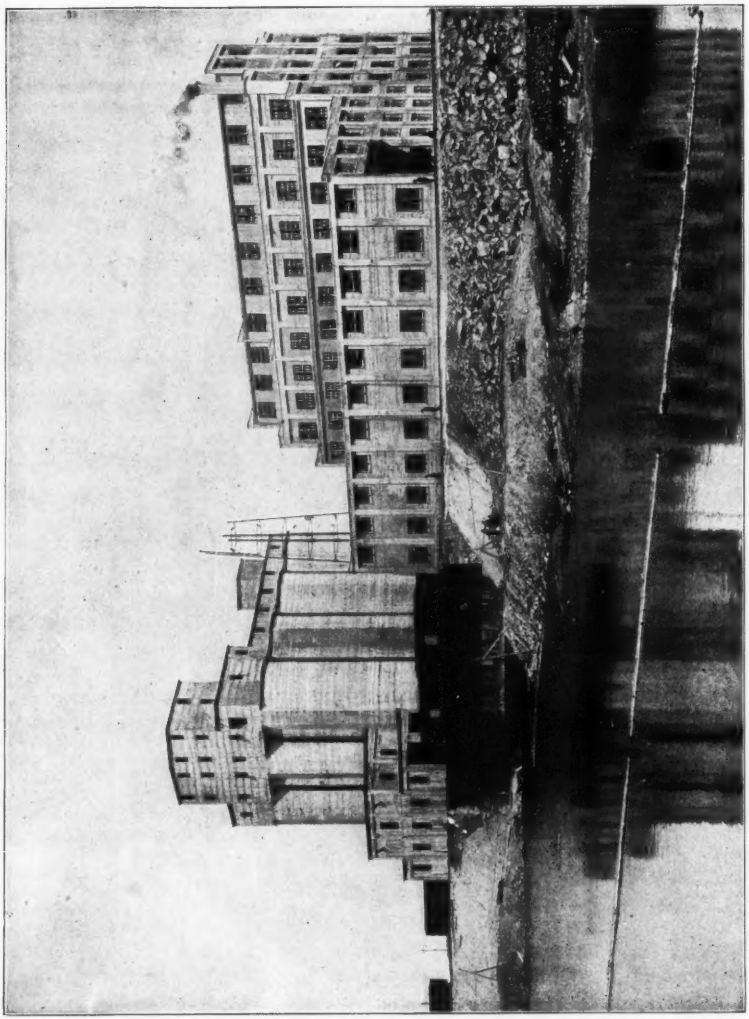
Primitive man plucked the heads of ripened grain, used his hands and lungs as cleaning machinery, with two stones improvised a mill for grinding, and secured the flour for his cake in jig time. Later he learned that two stones with roughened surfaces moving one upon the other gave a more satisfactory product. The next logical step was to put a pin and handle in the upper stone, and the *quern* or hand-mill was the result. Afterwards horse power, wind power and finally water power were used to turn the mill stones which should convert the raw cereal into a form from which a brawn-producing edible could be made. Wind mills were known as early as the eighth century, but it was not until as late as the early eighties of the century just past that the old mill stone process was forsaken for the present one in which rollers are used. The demand for finer flours for bread, cake and pastries has continually led to further reductions and gradings and more varied and complicated machinery.

From the rude savage whose mill consisted of a flat stone between his knees and a round one with which to pound thereon to the 16,000-barrel per day mill of the present is a long stride and one involving the introduction of many hazards.

Construction.

No attempt will be made in this paper to outline definite standards for flour mill construction. Within recent years a number of large up-to-date flour mills of reinforced concrete and other grades of fireproof or semi-fireproof construction have been erected, but these have generally been larger mills of a type not commonly found in Ohio and adjacent states.

A flour mill ought to be of mill or at least semi-mill construction with power features in a detached brick building or an adjoining brick



New Keewatin Mills, Keewatin, Ontario.—Mill, Storage Elevator and Warehouse of Reinforced Concrete.

addition cut off in a standard manner. As few vertical openings as possible should be made and these should be protected by traps or self-closing doors wherever it can be done. It is difficult, however, to cut off the different floors of a flour mill from one another for the reason that the large number of elevator legs, spouts, etc., running from the top to the bottom of the mill, cannot be trapped, and in a fire, act like so many flues to spread the flames.

The above is a general idea of what flour mill construction should be. What it really is we find to be greatly different. There are a number of flour mills in the state of Ohio and the Middle West of excellent construction, but the majority are very cheaply and poorly built.

The common type of country flour mill (which means mills found anywhere in towns of 25,000 or less), having a daily capacity of 50 to 100 barrels, is a three or four-story frame building of ordinary open finish construction with a one-story frame or brick boiler house adjoining and communicating and very seldom cut off. An open stairway generally runs from the bottom to the top of the mill. The proportion of brick and stone mills to those of frame or frame iron-clad construction is very low, and the majority of frame mills are rather light structures.

The New Keewatin Mill of the Lake of the Woods Milling Company, Keewatin, Ontario, is a modern mill of superior construction. The mill buildings, storage elevator and warehouse are built of reinforced concrete resting on solid rock. The wheat cleaning and wheat washing house is separated from the main building by a solid concrete wall. The storage elevator is connected with the main building by means of a belt conveyor by which all grain intended for the mill is conveyed to an elevator leg and re-elevated to the mill bins. All parts of the elevators are absolutely fireproof in construction, the roofs, floors and cupola enclosures being of reinforced concrete, fitted with wired glass windows and steel sash.

Occupancy.

The ordinary three-story mill is generally occupied as follows: 3rd floor, elevator heads, bolters, reels and cleaning machinery; 2nd floor, purifiers, dust collectors and bins; 1st floor, roller mills, flour packing, shipping, feed mills and corn shellers—if any, and office; basement, main line shafting; boilers and engines in adjoining addition on same level.

The above relations are generally preserved as regards the machinery no matter what the height of the mill may be, i. e., the bolters and reels are usually located at the top of the mill, the roller mills at or near the bottom and the purifiers somewhere in between. In the larger mills it is a common thing to cut off one end of the building by a division wall and locate all cleaning machinery therein.

The occupancy of the Keewatin Flour Mill is as follows: Cupola, elevator heads and dust collectors; 4th floor, bolters, purifiers and dust collectors; 3rd floor, purifiers and dust collectors; 2nd floor, spout rooms and reels; 1st floor, roller mills; basement, main line shafting.

General Remarks on Milling.

In order to gain a clearer conception of milling processes and machinery, a slight knowledge of the wheat berry and its properties is necessary.

The wheat berry is composed of four coats of woody fibre inside of which is a coat known as the gluten coat, and in the interior is a cellular substance whose main property is starch. Wheat cracked in a mortar gives a powder mixed with scales. Bolting or sifting separates the whole meal into two parts known as bran and flour. The former consists of the outer woody part of the grain with adhering portions of the interior; the remainder is called flour.

With refinements in the art of baking came a demand for a finer flour than could be secured by merely cracking the wheat berry and removing the coarser part or bran. New modes of milling were introduced and the product was separated into more numerous grades. It was customary at one time in the United States to divide the product into three grades: Flour, connell (shorts, or middlings) and bran. These three have been further increased by improved appliances, and in the best mills the grades of flour now produced number at least ten.

Without entering into the question of the food values of the constituents of the wheat berry let it suffice to say that the larger the percentage of the interior of the berry in the flour the smaller must be its nutritive value; and correspondingly, the larger the percentage of the gluten coat, or that next to the bran coats, the greater will be the nutritive value of the flour.

The problem of the miller, therefore, is to remove the outer covering, or bran, at the same time retaining the largest possible amount of the inner coat, or gluten.

Processes.

Grain that comes to a flour mill from a cleaning or storage elevator has already been put through several cleaning machines. Nevertheless in an up-to-date flour mill, no matter how well the grain may have been cleaned in the elevator, it is subjected to a final cleaning before it is allowed to enter the grinding machines. Thorough cleaning of wheat is now universally recognized as the first great step in milling. In modern mills oftentimes the grain is passed through two separators, a magnetic separator and two double scourers before being allowed to go to the rolls, notwithstanding the fact that it may have had one or two preliminary cleanings in the grain elevator.

After the grain has been thoroughly cleaned it is sent to the roller mills for grinding. The ordinary flour mill has from four to six breaks and ten reductions, which means that the grain is broken or crushed between four or six sets of corrugated rollers, the stock being separated by sifting machines after each grinding, the coarse stock going back to the breaks and the fine passed to the purifiers and between smooth rollers and

thence to the flour bins. Only a part of the stock travels through all of the breaks, as a large amount is taken out by sifters. The stock that comes from the last break is hardly anything but bran. This is sent to the bran dusters for cleaning and then passed to the feed bins. To enter more into detail, the grain is fed by a spout from the bins filled by the final cleaning machines, generally wheat scourers, to the roller mills (usually located on a lower floor); thence it passes through the first break or set of corrugated rollers which merely crush the grain enough to crack the berry open; this stock is then raised through an elevator leg to a higher floor to sifting machines (known by various names as bolters, sifters, plansifters, gyrators, etc.); the sifting machine divides the stock into three separations or parts: fine dust, middlings and coarse tailings; the fine dust after being dressed goes to the flour bin, the middlings to purifiers and thence to smooth rollers which reduce them to flour, and the coarse tailings go to the second break. The stock from the second and succeeding breaks up to the last one is treated in the same manner as that from the first, separations being made by sifting machines, the coarse stock returned to the third break, the middlings to purifiers for reduction and the fine dust passed to flour bins. In each successive break the rollers are set more closely together and have finer corrugations, so that the stock that comes from the last break is nothing more than the outer woody coats of the wheat berry crushed into flat flakes of bran. This is put through scalping reels and bran dusters to shake loose as much as possible of the gluten coat and then passed to the bran bins.

It may be noted that the flour milling process differs radically from most of those connected with the manufacture of other products in that, instead of the stock being freed from the waste or undesirable elements in the beginning of the process, it is retained until the last. Flour making is a process of separation, the desirable parts being slowly subtracted until only the waste or by-product is left.

Common Hazards.

It will be unnecessary to go at length into a treatment of the common hazards found in flour mills as the arrangements of the same do not differ greatly from those found in other special hazard and mercantile risks.

Power. At one time in the history of milling, water power was used almost altogether, but upon the introduction of the steam engine, prosaic boilers replaced poetical water wheels until at the present time water power mills are not common except along large and swiftly flowing streams. The majority of present day mills are operated by steam power, but since the gas and gasolene engines have become perfected these have in numerous instances taken the place of boilers and engines, especially in smaller country mills. Although not used actively, in most cases the boilers still remain in the mill as an emergency source of power.

The general arrangement of steam power in the country mill is as follows: Horizontal boilers encased in brick but generally unarched, with

metal stack through combustible roof, set in a one-story brick, frame or frame iron-clad addition, communicating and adjoining and seldom if ever wholly cut off.

Steam power installations should not differ greatly from those in other mills, and common rules for inspecting steam power hazards are applicable as a whole. One point that should be noted is that spark arresters should be installed on all stacks where cobs are used extensively for fuel. Gas engine installations vary widely, but as a general rule the exhaust passes through wood and is poorly arranged, and approved regulators are the exception, the majority being of the rubber bag or gasometer type. Nearly all gasolene engines are pump fed, but the tanks are rarely located underground at a sufficient distance from building.

Heating. Steam radiators and gas and coal stoves with their usual hazards are found, with steam heat more commonly used and held in greater favor because of the fact that the installation of heating arrangements which employ open flames has come to be regarded as poor practice where an explosion hazard from flying dust exists.

Lighting. Electric lights installed in accordance with the National Electrical Code with dust-proof sockets, and switches and cut-outs in dust-proof cabinets are the best lights for a flour mill. However, the larger number of mills have oil lanterns of an unapproved type (not dust-proof), and occasionally open flame gas jets may be found.

Shafting and Bearings. On account of the rapid accumulation of dust and dirt in flour mills it is imperative that the best possible installation of shafting and bearings should be made unless a great additional hazard be engendered. True alignment, easy accessibility, the installation of drip cups, and in fact, every feature which good practice prescribes are necessary to reduce the hazards to a minimum. It is not uncommon, however, to find drip cups missing, shafting out of alignment and even wooden journals.

Special Hazards.

Cleaning Machinery. As previously stated, wheat, although it has already been passed through several cleaning machines in the elevator, is not allowed to pass to the roller mills until it has been subjected to still further treatment. Considerable purification machinery may, therefore, be found in every flour mill.

Separators. Separators are similar to the old fashioned fanning mills but on a larger scale. A separator consists of a series of rotating sieves or screens mounted in a suitable frame with a fan attachment. Wheat is fed into the machine, being subjected to a strong air current which draws out dust, chaff, light oats, etc.; it then falls upon a series of coarse screens which remove straw, sticks, cobs, etc.; thence over screens of finer mesh which remove corn, but allow wheat, seeds, etc., to drop through; the last screens allow the small seeds to drop through and the wheat tails over. Cyclone dust collectors are usually attached to the receiving separators, and tubular collectors to the mill separators. Occasionally separators

have no dust collectors, but discharge to the outside of the building. The dust from the cyclone collectors on receiving separators is sometimes burned, but of late instead of being used as fuel it has been bagged and utilized for feed or fertilizer.

Cockle, often found in wheat, has the effect of cantharides, a deadly poison upon the human system. For its removal a separator with an indented cylinder is used. The grain first falls on a sieve, the large berries passing over the tail and out of the machine. The smaller grain and cockle fall through the sieve and enter the indented cylinder at the rear end. There are no holes in the cylinder but the indentations catch the cockle and small kernels of wheat which are carried up by the revolving cylinder and falling on same, roll into the spout. This machine may also be used as a grader, since only small wheat will stay in the indentations.

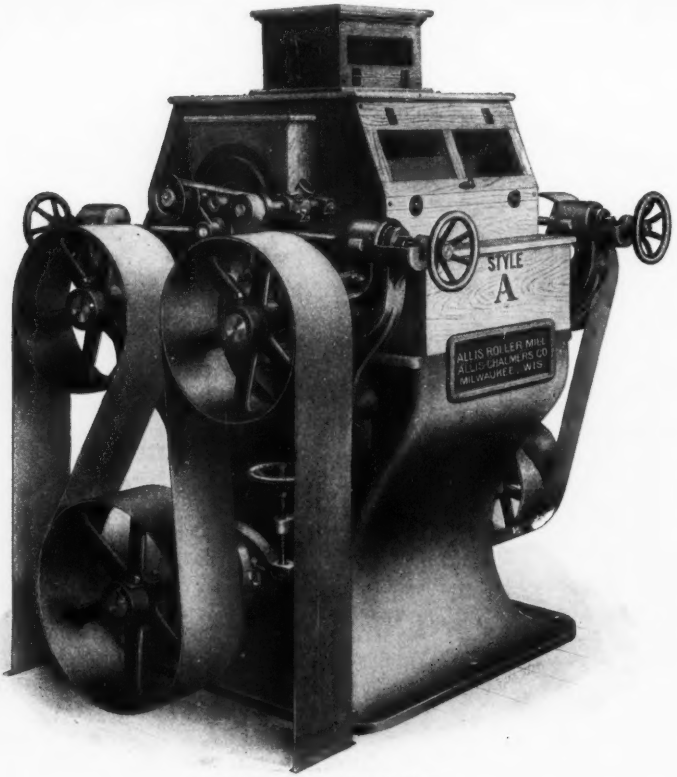
Grain in the preliminary stages of cleaning is oftentimes run through a separator containing magnets for the purpose of removing all nails, iron ore, bits of wire and other metallic particles, in order that same may not be carried to the rolls and a fire caused or machinery damaged by them.

Scourers or Smutters. After the wheat has been cleaned of extraneous substances by separators, and the smaller kernels removed by graders, the remainder goes to the scourer which eliminates dust, smut and rust which may cling to the wheat berry, especially lodging in the crease. The scourer is a polishing machine usually consisting of a vertical cylinder, the surface of which is covered with brushes, and a closely fitting iron case perforated with numerous slits or holes which serve the double purpose of making the surface rough and providing an escape for the separated dust. The grain while being subjected to the scouring process, is acted upon by a strong air current which sucks out all impurities detached from the wheat.

Aspirators. Where wheat is stored after scouring, before being sent to the rolls for reduction, it is sometimes passed through an aspirator for the removal of all dust that has settled upon it during storage. Air is drawn through the wheat as it passes through the aspirator, the dust being taken up and discharged by a fan.

Roller Mills. The hazard connected with roller mills is very slight and they are the cause of but few fires. The hazard from grinding may be almost disregarded, but over-heated bearings and friction due to a choke of stock are occasionally the cause of a fire.

The practice of heating or steaming wheat before it passes to the rolls has long since been recognized as often a necessity in successful milling. Heating wheat draws the natural moisture from inside the berry to the outside, thus to a certain degree toughening and loosening the bran. Steaming wheat has the same effect, by applying moisture to the outside of the berry. Either heating or steaming facilitates the removal of the bran, makes the bran broad and flaky and improves the color of the flour.



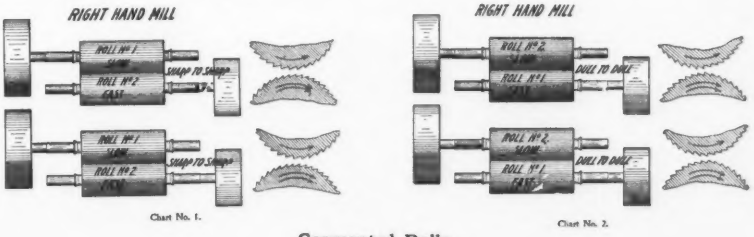
Roller Mill—Driving Side.

The hazards of cleaning machinery are considerable, as in addition to a shafting and bearing hazard which always exists to a greater or lesser degree, depending upon the rapidity with which the parts move, there is also a considerable dust explosion hazard, especially in scouring machines, since a spark struck by the machine may cause an explosion, if there is a proper admixture of air and dust at that time.

Grinding, Sifting and Dressing Machinery.

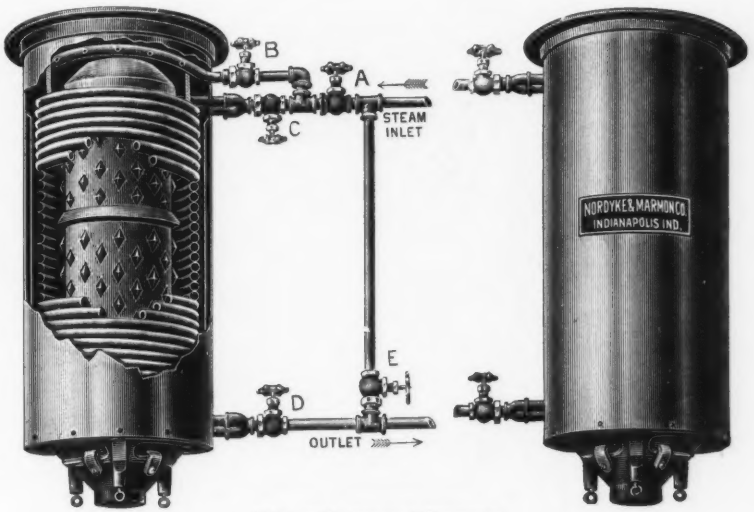
Roller Mills. As has been explained in a general way the purpose of the roller mill is to break up the grain. Smooth and corrugated, or grooved rollers, are placed in sets of three or four, one above the other, and so arranged that the crushing effect of any one set is slight. Six or seven sets are necessary to produce the numerous grades of flour. These rollers are regulated by gears to run at different speeds. Each manufac-

turer of roller mills claims special features for his mill which makes the grinding more nearly perfect.



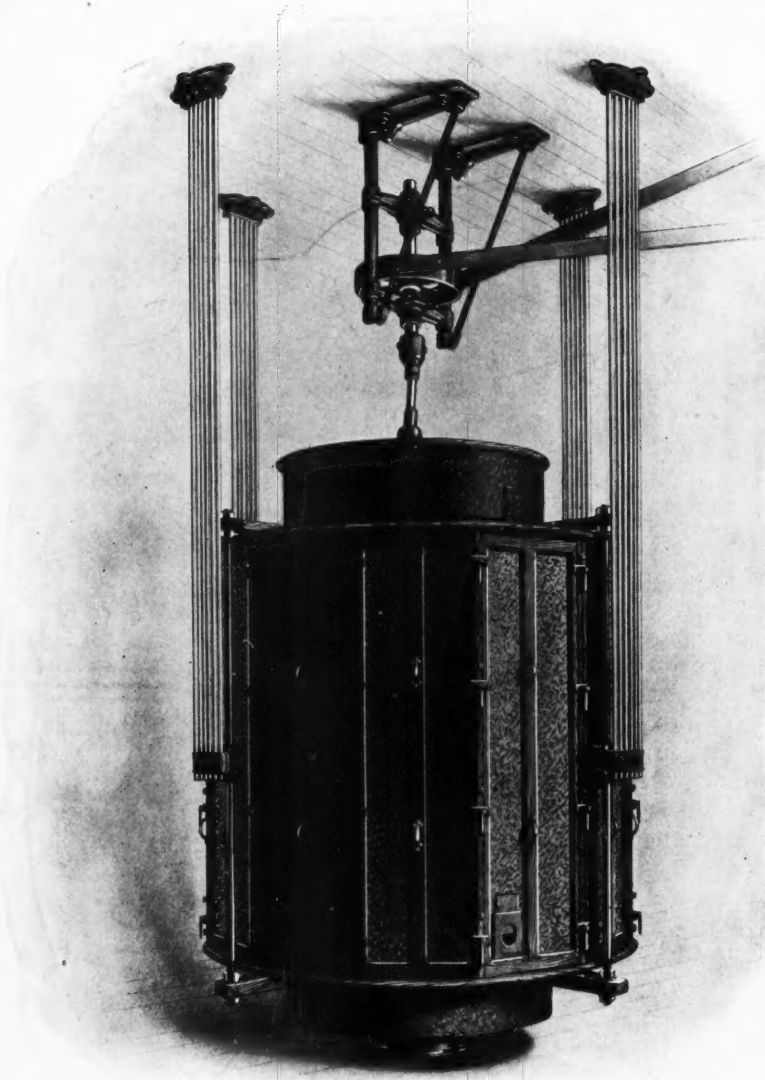
Corrugated Rolls.

Experienced millers agree that the roller mill is the prime factor in securing the best results in milling. The grinding must be done uniformly on each reduction, for if the reductions are not uniformly made the bolting and purifying processes are seriously affected, no matter how well adapted to their work the bolters and purifiers may be.



Wheat Heater and Steamer.

A combination wheat heater and steamer is illustrated herewith. To use it as a heater, the valves B and E should be closed and the valves A, C, and D opened. The wheat enters at the top, passing down between the steam cylinder and the steam pipe coil. The cylinder is so constructed



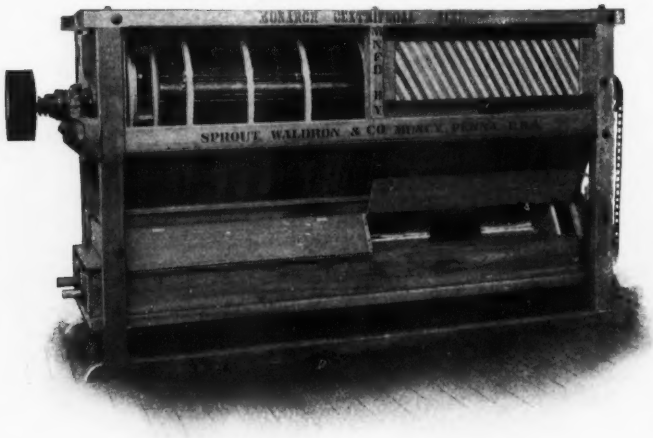
Bolter With Vibromotor Drive.

that the wheat is turned over and over in its course, and in this way the heat from both cylinder and coil is imparted evenly to each grain, insuring even tempering. The steam enters both the cylinder and the pipe coil through the valve C and passes out through the valve D. The valves B and C are needle valves which give perfect control of the steam, thus enabling the operator to regulate the temperature. When used as a steamer, the valves C and D are closed and the valve B is opened. The steam rises from holes in the pipe encircling the top of the cylinder and comes in direct contact with each grain as the wheat enters, steaming it evenly and sufficiently. As it is seldom that anything except steam is used in heaters, and this is generated at a distance in power boilers, there is very little hazard connected with these devices as long as steam pipes have ample clearance from wood.

Sifting Machines. The stock resulting from the breaks must be separated into its component parts for further treatment. Separations of this stock into flour, middlings and coarse tailings is secured by means of a variety of devices which are referred to as sifting, bolting and scalping machines. These consist of a series of centrifugal or other reels, and bolting chests or boxes, of various patterns and covered with different numbers of wire cloth and silk gauze, the numbers representing the various degrees of fineness of mesh. All sifting and bolting machinery is of two types, the revolving reel and the gyratory sieve. Both types are used extensively at different points in the milling process, but the latter type is now generally considered the better for bolting the break stocks.

Machines belonging to the gyrating type are known by such names as bolters, gyrators, sifters and plansifters, but while differing somewhat in the methods of securing the gyratory motion, they all depend upon the principle of the hand sieve. All are suspended by flexible reeds or other supporting devices, and rotated or shaken by means of some application of power. The body of the bolting or sifting chest suspended by the flexible reed is generally divided into several compartments in which sieves of wire cloth and silk gauze are stacked one above the other and so inclined or deflected that the stock not sifted through tails over. The sieves are cleaned by a circulation of locust seed or wheat, or by means of small independent brushes or other mechanical contrivances moving underneath the cloth.

Sifting machines of the revolving reel type have been largely supplanted by sieve bolters and sifters, but they are still used to some extent. Machines of this type have many different names as centrifugal reels, differential reels, round reels, hexagon reels, scalping reels, flour dressers and flour blenders. They are all very similar in principle and appearance, being oblong chests in which a reel covered with suitable numbers of silk revolves slowly and sifts the flour out of the stock that is fed into the reel, the coarse part tailing over. For keeping the cloth clean there is an arrangement of bristle brushes, so suspended over the top of the reel as to rest on the cloth. The centrifugal or differential reel differs from other reels of the revolving type in that it employs various devices of

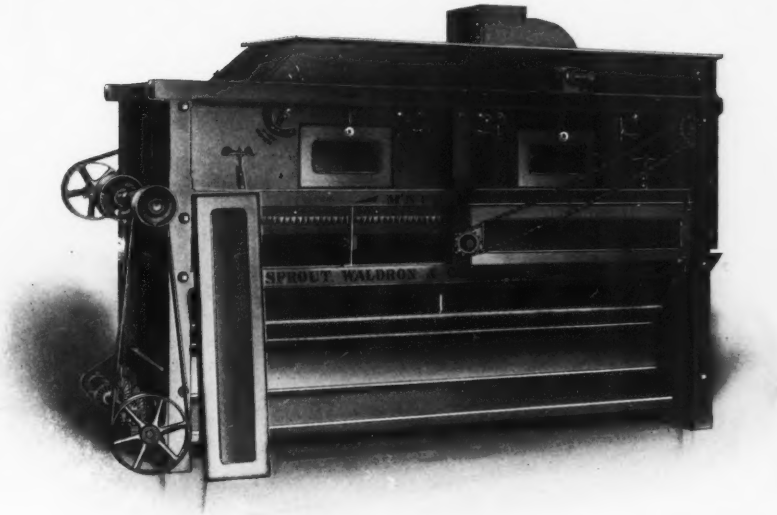


Centrifugal Reel.

beaters or wings on an axle in the center of the cylinder, the design of which is to secure a tangential or throwing movement of the stock, instead of the sliding movement of the ordinary reel. The beaters, of various shapes, lengths and sizes, are arrranged spirally about the central axle which revolves at a much higher speed than the reel. The centrifugal reel has been found especially applicable in the handling of stock of a flat, soft or somewhat lifeless character, on which its rapid and vigorous action has a disintegrating effect. Reels are generally used to scalp the bran out of the stock that comes from the last break and to treat certain other stocks for which the sieve bolters are not adapted.

Sifting machines are responsible for but few fires, the main hazard connected with them being that of over-heated bearings. As sifters and bolters are not fast running machines a great deal of friction is not set up in their bearings. Since the sieve bolter is now commonly used instead of the reel, a great many bearings are dispensed with, as machines of this type employ fewer bearings on account of being suspended.

Purifiers. Upon the systematic grading and purification of the middlings before they go to the smooth rollers for reduction, depends the fine art of flour making, for it is from the middlings, rich in gluten, that the best grades of flour are secured. The province of the purifier is to remove the impurities and fine material, and notably the bran particles, from granular product resulting from the gradual reduction of the wheat berry. Working by specific gravity and adjustable to middlings and impurities of varying degrees of fineness, it entirely eliminates the greater part of foreign or discoloring substances.



Middlings Purifier.

The purifier contains the following elements: An upward air-current through the covering of a reciprocating sieve clothed with silk of progressively coarser mesh from head to tail; an enclosed air-space above the sieve, divided by transverse partitions into separate compartments, having practically no communication with each other, and each opening into a chamber of an exhaust fan through an adjustable valve so placed as to permit the regulation of the strength of the air-current through each compartment separately; a series of dust settling chambers or testing drawers corresponding in number to the above mentioned compartments, and a brushing device automatically operated and working against the under side of the sieve clothing.

The hazard of purifiers is so very small that it may be regarded as negligible. Having no fast revolving parts there is but little danger of fire from friction; process hazards are so small as to be unworthy of consideration.

Bran Dusters. After the bran has been scalped out of the stock that comes from the last break it is sent to bran dusters for the purpose of shaking loose all adhering portions of the gluten coat in order that none of this valuable constituent of flour be wasted.

A fair type of the several varieties of bran dusters in use is a machine with an upright cylinder, covered with a wire cloth, the cylinder having adjustable brushes on the inside, secured to the central arm in such a way

Upright Bran Duster.

as to nearly touch the cloth. This cylinder revolves very rapidly and the bran, being fed into it from the top, must pass between the brushes and the sides of the cylinder. In getting through it is so thoroughly swept by the brushes as to remove from it all adhering particles of flour, which are forced through the wire cloth while the cleaned bran falls down and is carried away to the feed bins. An automatic knocker prevents the cylinder from becoming clogged. Some dusters of this type have a strong air-current which blows at right angles to the stream of bran flowing through the machine, carrying the flour particles through the cloth. Sometimes the cylinder revolves slowly and the spider to which the brushes are attached revolves at a differential speed much higher. Horizontal bran dusters operating in much the same manner as those of the upright type are used, but the vertical bran duster is held in greater favor and all up-to-date mills are equipped with machines of this type.

Since parts of the bran duster move at considerable speed there is always a friction hazard in these machines, but if proper bearings are provided the hazard is reduced to a minimum.

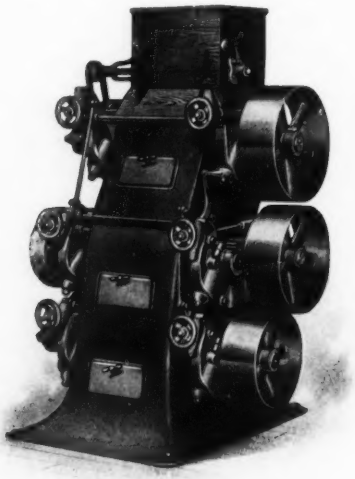
Dust Explosions and Dust Collectors. Flour and wheat dust when in a settled state are comparatively harmless, except that they aid in the clogging of shafting and heating of bearings, but when mixed with air in the proper proportions they become highly explosive. Of the two, wheat dust is the more dangerous when exposed to flames, especially if of a considerable age, as old dust seems to undergo a chemical change whereby it acquires explosive properties not possessed by new dust. It is certain that unless the dust from cleaning and milling machinery is carefully collected and disposed of, a grave dust explosion hazard is engendered.

With the introduction of the roller process of milling, with its numerous machines for reductions, there came a great increase in flour dust. Purifying and aspirating machinery, distinguished by the employment of air in rapid motion, keeps vast quantities of fine dust constantly in suspension in the air. At first attempts were made to blow this dust into rooms provided for the purpose, but this process was more or less ineffectual, much dust escaping removal or finding its way back into the mill. When, after a time, a number of disastrous explosions had occurred in mills employing improved methods, it was discovered that fine flour dust was the cause. Efforts were at once made to replace dust-rooms by some better device, these efforts resulting in the machine known as the dust collector. This machine has been so valuable in disposing of dust that dust explosions are no longer frequent in flour mills and elevators, and the air of the best equipped mills is so free from flying particles that the visitor to them is inevitably told that "the miller has to buy a white hat."

Two general types of dust collectors are found in flour mills and elevators, the tubular and the cyclone. Of these two types the tubular is the more commonly used in flour mills, the cyclone being best adapted to cleaning machinery found in elevators. The tubular type of dust collector may be found in two forms; viz., stationary, or upright, and revolving. The revolving tubular dust collector is the one usually found in flour mills. It consists of a cylinder with inner and outer ribs, around which flannel is wound from one piece, so that when complete there is an air-space the width of each rib between two flannel surfaces. The dust-laden air is drawn into the machine by suction and out through the cloth, leaving the dust behind. The cylinder is revolved slowly, rib by rib, by a ratchet, and as each rib reaches a point directly over the center of the bottom of the collector, it is tapped lightly by a knocker, which causes the dust to drop into a conveyor which carries it away from the machine. A back draft or reverse current of air is applied to that portion of the cloth being cleaned which facilitates the removal of the dust. Some revolving collectors instead of using knockers to shake the dust loose from the cloth employ a rotating cleaner, made of leather whippers or fingers, which move in and out of the spaces between the filtering pockets or ribs. The stationary tubular dust collector is generally suspended from the ceiling and operated on the same principle as the revolving tubular, the cloth tubes being cleaned either by means of a knocker or a traveling frame with cross strips running in either direction between the rows of tubes.

The cyclone dust collector is composed of a conical casing with a dust outlet below and an air outlet above. The dust-laden air is blown into the collector where it moves about in a vortical whirl, deflectors placed at certain angles overcoming a back pressure. The dust being heavier than air falls to the bottom of the cone while the air exhausts out of the top of the collector. Sometimes in large grain elevators a dust collecting system is installed to collect dust from the cleaning machines, the cyclone being placed on top of the boiler house with discharge leading to boilers. This kind of an arrangement is hazardous unless provided with a swing damper cut-off, for when the fan stops, sparks are drawn by a back pressure into the cyclone and through the pipes to the machines, where they may smoulder for hours before breaking into a flame.

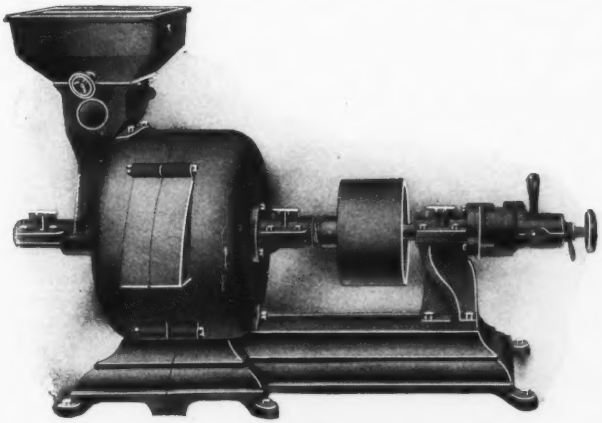
Dust collectors are attached to cleaning machines, purifiers and sometimes to suctions from rolls and elevators. The dust from collectors connected to grain cleaners is usually discharged into the feed bins, but sometimes cyclone dust collectors gather the dust from the receiving separators and discharge it into the boilers as described above. The dust from collectors attached to purifiers is usually redressed and passed to low grade flour bins.



Three Roller Feed Mill.

Feed Rolls and Mills. In many of the smaller mills where feed grinding is done, oftentimes the preparation of feed is such a considerable item that flour making is a minor feature. Combination flour and feed mills or custom grinding plants, commonly known as grist mills, may be equipped with a complete line of feed grinding machinery, but the ordinary flour mill possesses only one or two feed mills.

Feed Rolls or Roller Mills for the crushing or grinding of all kinds of grains such as barley, rye and wheat are similar to flour roller mills both in construction and operation. Fewer rolls set more closely together are employed, making the process of grinding more rapid and shorter.



Burr Mill.

Buhr (or Burr) and Attrition Mills are machines employed for the rough grinding of corn and cobs, shelled corn, oats, oat hulls, barley, screenings, buckwheat hulls, wheat and corn bran and in fact anything which can be ground up into feed. These mills instead of employing rollers have roughened stones or corrugated steel plates which turn upon each other and reduce the stock to feed, operating much the same as the primitive flour mill.

Other machines, such as **Corn Crackers, Corn Ear Crushers, Hominy Mills,** etc., may sometimes be found in flour mills.

All of the feed grinding machines are considered to be more hazardous than roller mills, because the grinding of corn, screenings, etc., is a more violent process, fewer rolls being employed since there is no need of gradual reductions of the stock as in flour making. The **Buhr and Attrition Mills** are the most hazardous of feed grinding machinery, as metal and other hard substances oftentimes get into the machine and cause a dust explosion or fire. A magnetic separator should be placed ahead of these machines.

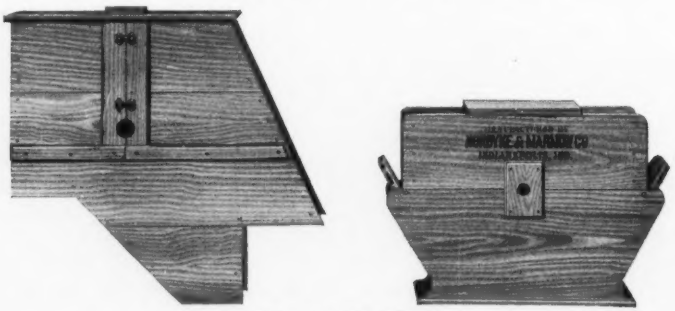
Conveyors. There are five general types of conveyors used in mills and elevators: drag, screw, pan, pneumatic and belt.

Fewer conveyors are used in flour mills than in elevators, as most of the handling of stock in mills is from one level to another and done by elevators. Those that are found are generally of the screw and drag type, and usually of no great length. Several milling machines such as purifiers have small conveyors in them to transfer the stock from one end of

the machine to the other. Mills with elevators attached generally have a belt conveyor which transfers the partially cleaned grain to the mill. In elevators, conveyors are used extensively for the purpose of transferring grain from one bin to another, from cleaning house to tanks, and from tank to tank.

The drag conveyor is a primitive type, the grain being dragged along a chute by means of projections on a chain. The pan conveyor is an endless chain provided with shallow pans or buckets. In the screw conveyor the grain is pushed along by helical planes arranged about an axis in the form of a screw. Pneumatic conveyors accomplish the transmission of grain or stock by means of air blasts, partial vacuums and valve arrangements. In belt conveyors the grain is transferred by being carried on the horizontal portion of a belt, fifteen inches to three feet wide and moving from 300 to 900 feet a minute. The belt is troughed at the point where the grain drops on it by passing it between pairs of rollers inclined to each other, after which it runs over flat rollers.

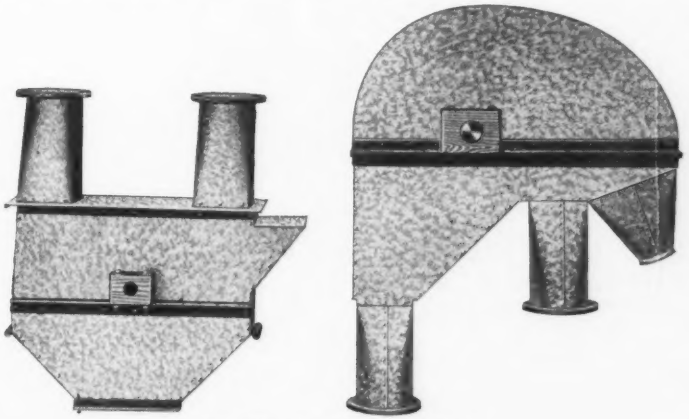
The hazards connected with the operation of conveyors are not numerous or great. They stir up the grain and free any dust in it, sometimes cause the bearings of rollers to become overheated, and those of the tight type, as the screw conveyor, when choked up, unless provided with release covers which automatically allow the stock to be diverted, pack the same and create considerable friction, which if allowed to continue, may cause a fire. Screw, drag and apron conveyors are usually enclosed in wooden chutes which serve to feed and spread flames. Belt conveyors, which are operated to transfer grain from one building to another, are generally located in covered wooden bridges which afford avenues for drafts and transmit mutual exposures to buildings which they connect.



Wood:n Elevator Head and Boot.

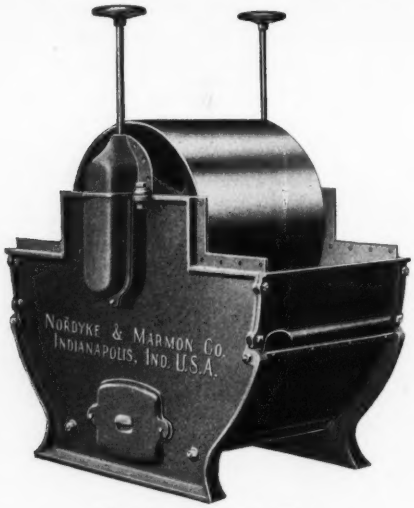
Elevators. Elevators for lifting grain or ground stock from a lower to a higher level consist of a head, two legs or chutes, and a boot with a pulley in the head and another in the boot over which runs a leather, rubber or canvas belt to which are attached the grain cups. Sometimes the two legs are built as one, the up and down portions of the belt traveling in the same channel instead of in separate chutes. Elevators with two

legs usually have strut boards underneath the head pulleys which enclose the driving mechanism. If this strut board is inclined so that the grain and dust dropping upon it may fall into the up leg, the elevator is said to have a hoppered head; if the strut board is horizontal, the elevator is spoken of as having an unhoppered head. Inclining the strut board to both legs, making it appear like a peaked roof, is undesirable, since part of the refuse will slide into the down leg. A self-dumping, hinged and counter-balanced strut board is not desirable, as it is found that the mechanism gets out of order. Elevator heads and boots are generally so arranged that they may be cleaned by hand. The head pulley drives the belt, the pulley in the boot acting somewhat like an idler. Elevator heads, legs and boots are generally made of wood, but chain elevators with metal casings are sometimes used.



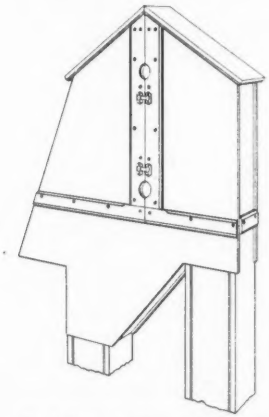
Iron Elevator Head and Boot.

Elevators constitute one of the greatest hazards of mills and grain elevators. On account of the grain handled being dustier, the elevator is a more serious hazard in elevator buildings than in flour mills, although many mills of smaller size receive uncleaned grain from wagons and cars and perform all the necessary cleaning within the mill. Unless strut boards are self-cleaning (hoppered) a pile of stray grain and dust accumulates on the horizontal surface until it touches the pulley and is finally ignited, being fired either spontaneously or by heated bearings. The friction of bearings, pulleys and belt generates considerable heat, but ordinarily no harm results. Quite frequently, however, a choke-up occurs and the belt ceases to move; the pulley at the head, being positive in action, continues to rotate until if the choke-up is not noticed, the belt burns in two and the burning ends drop down into the legs and start a fire. Chokes occur in two ways—from a clogging in the up leg and from a clogging in the down leg.



Cast Iron Elevator Boot.

As elevators extend from the bottom to the top of the mill or elevator, they act like flues in carrying fires originating in them to all floors of the building.



Sprinklered Elevator Head.

Grain Dryers. The demand for artificially dried grain for shipment has led to the installation of various drying devices in elevators, and occasionally such devices are placed in flour mills for the purpose of thoroughly drawing all moisture out of the wheat prior to storage or being ground.

The general forms of dryers may be classified as direct-heated rotaries, steam-heated rotaries and stationary dryers heated by steam coils or by hot air from furnaces or air blown through steam coils. Direct-heated rotaries are no longer commonly used, on account of the great hazard connected with them, and so no specific treatment is necessary. Steam-heated rotaries, consisting of wooden or iron drums, slightly inclined to the horizontal so that the grain is tumbled over and over from one end to the other, are frequently met with in flour mills and are generally safe, nothing more than a steam hazard being involved.

The commonest grain dryer used in connection with elevators and with some of the larger mills is the stationary type. These dryers are generally independent of the mill or elevator. A stationary dryer in which are arranged steam pipes upon which grain rests temporarily, and another which is practically a cooker such as is found in oat-meal mills, consisting of a series of steam-heated pans upon which the grain drops successively, being stirred about and moved along by paddles, are sometimes found. The first of these dryers, unless constructed throughout of metal or other incombustible materials, is very hazardous; and the latter, to be desirable, should be as near incombustible as possible, with steam pipes clear and so arranged as to be easily accessible for cleaning and inspection.

The stationary dryer held in greatest favor by both users and insurance companies is the one in which the grain is at rest while hot air from steam coils is blown through it. There are several types of blower and coil dryers, but the principle of drying by blowing air through grain arranged in vertical columns or on slanting shelves is about the same in all, the principal points of difference lying in the mechanical arrangement and materials used.

The hazards of grain dryers vary greatly according to the type and arrangement, but those given below are generally present, being impossible of elimination. The use of blowers somewhat increases the danger of fire, fans driven at high speed being susceptible to hot bearings, and hot air forced through small passages increasing the carbonizing effect. Forced draught causes the circulation and accumulation of dirt and grain dust and increases the danger of dust explosion. A steam pipe hazard, not large if properly guarded, is also engendered. If apparatus is in building the drying out and preparation of surrounding wood-work for a rapid spread of fire is brought about. A power hazard incidental to the operation of apparatus is also present.

Grain Bleachers. The fumes of burning sulphur directed upon grain serve to bleach it. This principle is employed in grain bleachers, which ordinarily are not especially hazardous, unless the sulphur burning furnace is located too near combustible materials. Those who best understand the art of bleaching claim that sulphur flour burns through a distance of 25 feet, which means that the fumes are not all converted into sulphur gas until they have traveled that distance from the furnace. It is also claimed that the best results are obtained when the fumes do not enter the

bleacher too hot, so that if the arrangement is such as to secure good bleaching there will be no serious hazard if sufficient space to elevator or mill is maintained.

Flour Bleachers. A process of passing flour through air which has been subjected to the action of an electric arc for the purpose of making it whiter, has been used considerably in recent years in connection with flour mills. The gas and bleaching medium produced by the disruptive discharge of electricity on air is not inflammable or explosive, so that the only hazard in conjunction with this process is purely an electrical one. However, this is considerable unless the installation is made in strict accordance with the requirements of the National Electrical Code for apparatus installed where there is flying dust and an existing dust explosion hazard.

Few flour bleachers are found in the smaller mills, and there is a probability of the process being prohibited altogether, as the Board of Food and Drug Inspection has ruled that the bleaching of flour makes the product injurious to health and that the process, therefore, is in conflict with the pure food laws. The question has not yet been thoroughly tested in court.

Spontaneous Combustion. A large proportion of the fires caused by special hazards in flour mills and elevators are attributed to spontaneous combustion. Probably a number of fires not caused by spontaneous combustion are so classified because it is not known to what else to attribute them. However, it is certain that a spontaneous combustion hazard of considerable magnitude will always exist in grain handling and working plants, and too great care cannot be exercised in connection with the storage of raw materials and finished products and the prevention of dirt and dust accumulations. Green or improperly dried grain subjected to pressure, dampened feed stock, screenings, gluten feed stock, and grain and flour dust, mixed with oil from bearings, have all been known to produce sufficient heat within themselves to cause destructive fires.

Mediterranean Moth. The Mediterranean or Hungarian Moth, a pest introduced into this country from foreign mills, is one of the miller's chief woes. The female moth or fly lays from 200 to 250 eggs, which hatch out in nine weeks larvae or worms which become very active, spinning a fine silken thread in flour and over bolting cloth, causing conveyors to become choked up because of stock being held together in lumps by the fine threads and bolting machinery to be inoperative because of the cloth in the same being rendered useless. This pest in itself causes no fires, nor are the many means taken to exterminate it especially hazardous, although several poisonous gases diffused throughout the mill, after it has been tightly closed up, for the purpose of killing the moth, are highly explosive. The great menace to the insurance fraternity interested in flour mills, which this pest affords, is more of a moral than a physical hazard. The moth breeds rapidly and is very hard to exterminate once it takes possession of a mill, especially if the mill is old and of a low order of construction. The miller finding it impossible or too expensive to rid

his mill of the pest, and being unable to dispose of a contaminated product, is quite likely to become so "careless" that a disastrous fire results.

Protection.

The majority of flour mills are poorly provided with both inside and outside protection. The larger mills, of course, are generally equipped with as much inside protective apparatus as is practicable, but the greater proportion of mills are of the country type and these as a rule are very poorly protected.

Sprinkler equipments are installed in many of the larger mills, but because of the nature of the milling risk, sprinklers are not as efficient in the protection of flour mills as they are in safeguarding special hazard risks in general. Sprinkler apparatus, very effective in the general class of risk, is not of great value as an extinguishing agent in flour mills because of the poor conditions which prevail for its installation. The many vertical openings due to spouting, elevator legs, belt holes, passenger belt elevators, stairways, etc., the high combustibility of mills because of inferior construction and dust-covered walls and ceilings, the presence of air draughts and large floor areas, present conditions which render flour mills impossible of full and complete sprinkler protection. Dust explosions constitute a grave menace to sprinkler equipments, as it is a common experience for the flames to explode dust which shatters the system so that it is inoperative before the sprinklers have an opportunity to extinguish the fire. When sprinkler systems are installed in flour mills, it is important that sprinklers be placed in all elevator heads and as close together as possible without interfering with the operation of one another.

Standpipe and hose systems, when properly installed and maintained, are considered to be very good protection in milling risks. They may generally be found in all mills located in towns which possess waterworks, but installations are generally below standard and hose is not regularly tested and kept in good condition.

Chemical extinguishers are seldom found in flour mills, casks and pails being used instead. In fact the cask and pail installation is the miller's greatest protection against fire, and nearly all mills have them. As a whole the installations are good and well maintained.

It is almost impossible to find a country mill that employs a watchman who is under the supervision of a clock. The majority of the larger mills, of course, have standard watchman's clock services, but the smaller mills usually have no one who patrols the premises at night, and when a watchman is employed no check is put upon him.

Mills situated in cities and in the larger villages have fairly good outside protection, but a greater part of milling risks are located in towns of such a size that the public protection is very inferior or altogether lacking.

Whitewash and fireproof paint are quite commonly used upon the walls and ceilings of mills, and serve as excellent fire retardants.

Administration.

The management of a mill is a very important consideration in determining whether it is a good fire risk. Perhaps no class of risk affords a manager a better opportunity to display his ability to so administer affairs as to reduce fire hazards to a minimum than does the flour mill. At best a mill is bound to be a dusty place, and unless great care is exercised in keeping the mill swept down, the bearings well oiled and free from dirt, etc., a grave additional hazard will be engendered. In mills of a capacity of 200 barrels per day or over one man can find steady employment oiling and cleaning bearings, sweeping, looking after fire appliances and acting as a general caretaker, and the money put into his wages should prove to be one of the best investments which a miller could make. The larger mills are generally under able managements, but the country mills, while nearly always under the personal direction of the owners, as a general rule, are not well managed. Operators of the smaller mills, although they have a great deal at stake, either through indifference or ignorance, are generally very careless managers, and allow conditions of both buildings and premises to become so poor that oftentimes an additional charge is necessary in figuring insurance estimates.

Because of the dust explosion and spontaneous combustion hazards which exist in flour mills, dust and dirt should not be allowed to accumulate; machinery should not be too closely crowded together; "no smoking" signs should be posted; bearings should be given careful attention; fire appliances should be well mantained; and waste cans should be provided wherever oily waste is used.

Fire Record.

The fire losses of flour mills are so very high that this kind of business is not eagerly sought after by the insurance companies in general, and then only at rates which at first glance appear exorbitant. The majority of flour mills are carried by Mutual insurance companies.

The main reasons why flour mills burn, we would say, are: first, many internal hazards; second, high combustibility, because of the large percentage of frame construction and interior conditions conductive to a rapid spread of flames; third, inadequate protection, because of the large proportion of flour mills being located in small towns; fourth, moral hazards. The internal hazards, both common and special, are always considerable in milling risks, and these are usually poorly guarded. Once the mill is afire, because of the dust-covered walls, combustibility of contents and low order of construction, being usually frame, it generally makes a quick-burning fire and a total loss. The inside protection of flour mills is usually inferior, and outside protection as a whole is very poor, because of the fact that a large percentage of mills are necessarily located in small towns which do not possess adequate apparatus and fire fighting facilities to cope with a rapidly burning three or four story frame building.

Below are given the causes of 482 fires occurring in flour mills, covering a ten-year period from 1897 to 1907, being taken from the records of the Millers National Insurance Company:—

No. of Fires.		Per Cent.
241	Totally destroyed	50.00
241	Partially destroyed	50.00
482		100.00

Kind of Power Used.

1	Water and gas	.21
1	Steam and electric	.21
2	Steam and gas	.41
3	Gas	.62
4	Electric	.82
30	Water and steam	6.22
79	Water	16.39
362	Steam	75.12
482		100.00

Time of Day Fires Occurred.

17	No hour given	3.53
123	Daylight	25.52
342	Night	70.95
482		100.00

Cause of Fires.

210	Unknown	43.57
38	Lightning	7.88
34	Exposure	7.06
24	Spontaneous combustion	4.98
22	Grain cleaners	4.56
19	Incendiary	3.94
18	Hot boxes	3.74
16	Friction in elevator heads or boots	3.33
10	Sparks from locomotives	2.07
10	Sparks from smoke stacks	2.07
7	Defective electrical wiring	1.45
7	Friction of metal in rolls	1.45
6	Defective chimneys	1.25
5	Friction in separators	1.03
5	Overheated stacks or breechings	1.03
5	Friction (not otherwise stated)	1.03
4	Overheated stoves	.83
4	Friction of belting	.83
4	Defective boiler settings	.83
3	Explosions of dust	.62
3	Hot eccentrics in bolters	.62
3	Corn shellers	.62
3	Natural gas (fuel)	.62
2	Stacks burning out	.41
2	Explosions of lanterns	.41

No. of Fires.		Per Cent.
2	Tinner's fire pots	.41
1	Break in gas pipe fired by lantern	.21
1	Starting water wheel	.21
1	Sparks in woodpile from engine room	.21
1	Bolting machinery	.21
1	Oily waste	.21
1	Hot step of upright shaft of bolting chest	.21
1	Overheated steam pipes	.21
1	Sparks from suction fan	.21
1	Overheated meal dryer	.21
1	Ignition of straw used for fuel	.21
1	Sparks from Roman candle	.21
1	Brush machine	.21
1	Careless use of matches	.21
1	Electric motor	.21
1	Lamp upset	.21
1	Slaking lime	.21
482		100.00

Operation of Mills in Which Fires Occurred.

160	In operation when fire occurred	33.20
287	In operation the previous day	59.54
35	Not in operation the previous day	7.26
482		100.00

Classification of Causes.

210	Unknown	43.57
131	Common causes	27.18
88	Special hazard causes	18.25
34	Exposure	7.06
19	Incendiary	3.94
482		100.00

From a study of these fire records it was found that the main causes of fire in flour mills in the order of the numerical strength were as follows: unknown, lightning, exposure, spontaneous combustion, grain cleaners, incendiarism, hot boxes, friction in elevator heads and boots, sparks from locomotives, sparks from smoke stacks, defective electric wiring, friction or metal in rolls, defective chimneys, etc. If these records are not misleading, it would appear as though the worst special hazards to be found in flour mills are: spontaneous combustion, cleaning machinery, journals and elevators.

Specifications, Rules and Requirements

PUBLISHED BY THE

National Board of Fire Underwriters

UPON RECOMMENDATION OF

THE NATIONAL FIRE PROTECTION ASSOCIATION, THE CONSULTING ENGINEERS, AND THE UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION.

SUBJECTS.	Last edition.
Acetylene Gas Machines and Storage of Calcium Carbide	1908
Coal Gas Producers (pressure and suction systems)	1908
Electric Wiring and Apparatus, Installation Rules (Nat'l Electrical Code)	1909
Electrical Fittings, List of Approved	October, 1909
Fire Departments, Private	1902
Fire Doors and Shutters	1908
Fire Extinguishers, Chemical (for other than fire department use)	1909
Fire Hose, for fire department use	1909
Fire Hose, for private department mill yard use	1909
Fire Hose, Unlined Linen, for use inside buildings	1909
Fire Pumps (steam)	1908
Fire Pumps (electric)	1904
Fire Pumps (centrifugal)	1909
Fire Pumps (rotary)	1909
Gas and Gasolene Engines	1905
Gasolene Vapor Gas Lighting Machines, Lamps and Systems	1906
Gasolene Vapor Stoves, for cooking and heating	1903
Grain Dryers	1901
Hose Couplings and Hydrant Fittings, for public fire service	1908
Hose Houses, for mill yards	1905
Incubators and Brooders	1908
Kerosene Oil Pressure Systems	1902
Lightning, Protection Against	1907
Oil Storage (fuel), storage and use of fuel oil and construction and installation of oil burning equipment	1902
Oil Storage (inflammable), systems for storing 250 gallons or less of fluids which at ordinary temperatures give off inflammable vapors	1904
Railway Car Houses (storage and operating), Construction and Protection of	1907
Signaling Systems, used for the transmission of signals affecting the fire hazard	1907
Skylights	1906
Sprinkler Equipments, automatic and open systems	1905
Steam Pump Governors and Auxiliary Pumps	1908
Uniform Requirements ("slow-burning" construction, "inferior" construction, general hazards, oil rooms, general protection, stairway and elevator closures, watchmen, thermostats, etc.)	1906
Waste Cans, Ash Cans, Refuse Barrels, Fire Pails and Safety Cans for Benzine and Gasolene	1903
Wired Glass and Metal Window Frame Construction	1906
Underwriters' Laboratories, general information in reference to the nature of its work and the terms and conditions under which tests of fire appliances and materials are conducted	1909

A copy of each revised edition of the above pamphlets is mailed to members of the National Fire Protection Association on publication. Members desiring additional copies may obtain the same, without charge, by addressing the Secretary.

Approved Devices and Materials.

There are listed below in form convenient for reference by members the names and addresses of manufacturers of devices and materials which have thus far been favorably passed upon by the Devices and Materials Committee, following examinations, tests and recommendations made by Underwriters' Laboratories, Inc.

The Laboratories have also issued reports giving ratings unfavorable to a large number of appliances. A summary of the findings in each case can be obtained by addressing the Laboratories and any Active or Associate member can receive regularly the cards issued by the Laboratories giving summaries of the results obtained in the current work in all of its departments upon payment of the subscription price of fifteen dollars ($15) per year.

In the lists which follow members should note particularly that in those industries to which the label service has been extended (indicating inspection of goods by Laboratories' engineers at factories before shipment) **only such of the product of these factories as bear the labels referred to** are covered by the endorsement of the Committee.

BUILDING MATERIAL.

Post Cap and Girder Support (Steel and Malleable Iron).

Caps inspected at factory bear structural material labels attached to an exposed side.

The following companies are equipped to supply these devices:

Chicago, A. M. Castle & Co., 217–221 N. Jefferson Street.
Cleveland, The Duplex Hanger Co.

Asbestos Building Lumber.

Asbestos Lumber is considered from the insurance viewpoint as superior to wood for the uses intended.

The following company manufactures this material:

Ambler, Pa., Keasbey & Mattison.

Sagax Wood.

Made of ground straw, a cement binder and a few other ingredients, the exact composition being regarded as a trade secret.

Laboratory tests indicate that this material is non-combustible, a good non-conductor of heat, and when made in large sections of sufficient thickness is only slightly injured by high temperatures and the subsequent application of water. It absorbs moisture slowly, is considerably heavier and more brittle than wood and can be worked with ordinary wood-working tools.

The following company manufactures this material:

Baltimore, Md., Sagax Wood Co.

Wall Hanger (Steel).

Hangers inspected at factory bear above structural material labels attached to an exposed side.

The following company is equipped to supply this device:

Cleveland, Ohio, The Duplex Hanger Co.

CARBONIC ACID GAS HAND FIRE EXTINGUISHERS, 3 Gallons.

Carbonic Acid Gas Hand Fire Extinguishers shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with the rules of the National Fire Protection Association and examined and tested at factories and passed by Underwriters' Laboratories, Inc., have metal label soldered to the front of the cylinder, reading:

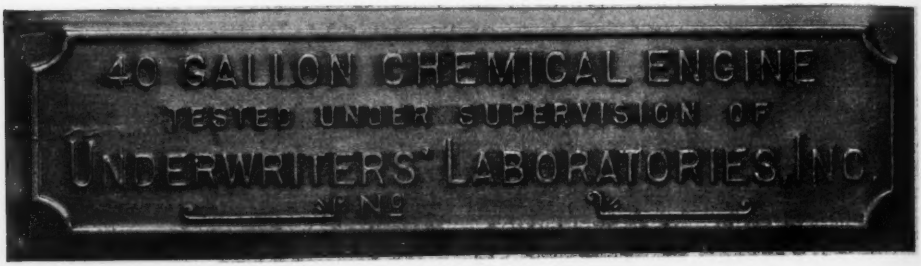
The following companies are equipped to supply these devices:

Ansonia, Conn., Metropolitan Fire Extinguisher Co., 1133 Broadway, N. Y.
Boston, Badger Fire Extinguisher Co., 32 Portland Street.
Boston, Knight & Thomas, Inc., 99 State Street.
Boston, The Standard Extinguisher Co., 78 Portland Street.
Buffalo, Buffalo Chemical Fire Extinguisher Co., 154 Ellicott Street.
Buffalo, Western Inspection Co., 45 N. Division Street.
Chicago, Miller Chemical Engine Co., 220–222 W. Huron Street.
Chicago, Staff Fire Extinguisher Co., 543-545 Orleans Street.
Cincinnati, Harker Mfg. Co., 118 W. Second St.
Columbus, Seagrave Company, South High Street.
Elmira, N. Y., American-LaFrance Fire Engine Co.
Minneapolis, Minn., Northern Fire Apparatus Co., 1301–1307 Third Street, South.
Montreal, Can., The Garth Co., 26–32 Craig Street, West.
Newark, N. J., The Tea Tray Company of Newark, N. J., Mulberry and Murray Streets.
Petrolia, Ont., Canada, Stempel Mfg. Co., Ltd.
Philadelphia, James Boyd & Bro., 14 North Fourth Street.

Pittsburg, Fire Extinguisher & Supply Co., 1414–1422 Spring Garden Avenue, N. S.
Pittsburg, Pittsburg Lamp, Brass & Glass Co.
Portland, Me., Conqueror Fire Extinguisher Co., 120 Exchange Street.
Racine, Wis., Racine Iron & Wire Works, 1022 Douglas Avenue.
St. Louis, Frank & St. Gemme Mfg. Co., 815–817 Market Street.
St. Louis, Missouri Lamp and Mfg. Co., 116 Elm Street.
St. Louis, Stempel Fire Extinguisher Mfg. Co., 4250 North 20th Street.
Toronto, Canada, Victor Fire Extinguisher Company, 704 Continental Life Building.
Utica, O. J. Childs Co., 50 Liberty Street.

CARBONIC ACID GAS FIRE EXTINGUISHERS, 40 Gallons.

Carbonic Acid Gas Fire Extinguishers of 40 gallons capacity mounted on wheels, shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association and examined and tested at factories and passed by Underwriters' Laboratories, Inc., have metal label soldered to the front of the cylinder reading:



The following companies are equipped to supply these devices:
Boston, Badger Fire Extinguisher Co., 32 Portland Street.
Elmira, N. Y., American-LaFrance Fire Engine Co.

DOORS AND SHUTTERS

for Openings in Fire Walls.

Tin-Clad Fire Doors and Shutters.

Standard Tin-Clad Fire Doors, shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc. are labeled by stamping in the tin plates or by attaching brass labels, reading:

Standard Tin-Clad Fire Shutters, shown by tests and examinations conducted by Underwriters' Laboratories, to be in accordance with requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by stamping in the tin plates or by attaching brass labels, reading:

The following companies are equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installations are made.

Akron, O., The Kasch Roofing Co., 16-24 Canal Street.
Atlanta, Ga., Dowman-Dozier Mfg. Co., 605 Rhodes Bldg.
Aurora, Ill., National Fire Door Co.
Brooklyn, Hiram A. Akerly, 173 Berry Street.
Buffalo, Chas. Bauers' Sons, 159 William Street.
Buffalo, Philip Christmann & Sons, Corner Virginia and Orange Streets.
Buffalo, Dusing & Hunt, 76 Main Street.
Buffalo, Machwirth Bros. Co., 201–209 Oak Street.
Buffalo, G. H. Peters & Co., 289–293 Oak Street.
Buffalo, F. J. Tingler & Son, 121 W. Eagle Street.
Chicago, Lyon Fire Door Co., 1741-3 Walnut Street.
Chicago, J. C. McFarland & Co., 27th Street and Fifth Avenue.
Chicago, Variety Mfg. Co., Carroll and Sacramento Avenues.
Cincinnati, J. H. Shields, 231 Sycamore Street.
Cleveland, J. Callaghan & Son, 1119 Superior Avenue, near Twelfth Street, N. E.
Cleveland, Cleveland Metal Roofing & Ceiling Co., 3103–3105 Detroit Avenue.
Cleveland, Cleveland Sheet Metal Works, 6933–5 Superior Avenue.
Cleveland, Mannen & Esterly Co., 2241–2255 St. Clair Avenue, N. E.
Cleveland, The O'Donnell Safety System Co., 3062 Superior Avenue, N. E.
Cleveland, The Ohio Roofing Co., 1477 Euclid Avenue.
Cleveland, Riester & Thesmacher Co., 325–329 Pearl Street.
Cleveland, Rudolph & Son Co., 1416–1420 Prospect Avenue, N. W.
Columbus, Kinnear & Gager Mfg. Co., 326 Mt. Vernon Avenue.
Columbus, National Fire Equipment Co., 192 E. Long Street.
Columbus, F. O. Schoedinger, 146-8 N. 3rd Street.
Galveston, Texas, Texas Sheet Metal Works, 2624–2626 Mechanic Street.
Hoboken, N. J., The Leonard Sheet Metal Works, 215–221 Grand Street.
Holyoke, Mass., Coburn Trolley Track Manufacturing Co.
Kansas City, Geo. W. Johnson Mfg. Co., 209–11 W. 17th Street.
Louisville, Ky., J. F. Wagner & Sons, 1145–1149 Seventh Street.
Milwaukee, Biersach & Niedermeyer Co., 220 Fifth Street.
Milwaukee, Consolidated Sheet Metal Works, 661–673 Hubbard Street.
Milwaukee, R. Jeske & Bro., 111-119 Reservoir Ave., cor. Buffum.
Minneapolis, Selden Roofing and Manufacturing Co.
Minneapolis, Stremel Bros. Roofing & Cornice Co., 1215–1219 Washington Avenue, North.
Minneapolis, Variety Fire Door Co., 123 Western Avenue.
Newburyport, Mass., Victor Manufacturing Co.
New Orleans, American Sheet Metal Works, Carrollton Avenue and Edinburgh Street.
New Orleans, Estate of R. G. Holtzer, 317–323 Burgundy Street.
New Orleans, A. J. Nelson Manufacturing Co., Ltd.
New Orleans, New Orleans Roofing and Metal Works, Scott, Toulouse, St. Louis Sts., and Carrollton Avenue.

New York, J. F. Blanchard Co., 23d St. and Broadway.
New York, Howell & Lawrence, 1788 First Avenue.
New York, Knoburn Co., 27 East 22d Street.
New York, Manhattan Fireproof Door Co., 412–422 E. 125th Street.
New York, John W. Rapp, 1 Madison Avenue.
New York, M. F. Westergren, Inc., 213–221 E. 144th Street.
Paterson, N. J., Hugh C. Lendrim Co.
Philadelphia, David Lupton's Sons Co., Allegheny Avenue and Tulip Street.
Philadelphia, The J. S. Thorn Co., 20th and Allegheny Avenue.
Pittsburg, Perritt Iron & Roofing Co., 6 Brushton Avenue.
Richmond, Ind., Richmond Safety Gate Co.
San Francisco, Forderer Cornice Works, 16th Street and Potrero Avenue.
San Francisco, Rulofson Metal Window Works, 315–319 Monadnock Building.
San Francisco, San Francisco Cornice Co., Bryant Street, between 9th and 10th Streets.
St. Louis, Albert & Fischer Hardware & Sheet Metal Co., 2529 South Broadway.
St. Louis, Caplan Galvanized Iron Cornice Co., 4412-4414 Easton Avenue.
St. Louis, J. Eberle & Son, 2014–2016 Laclede Avenue.
St. Louis, Gerock Bros. Mfg. Co., 1352 Old Manchester Road.
St. Louis, O. K. Harry Steel Works, 2333–5 Papin Street.
St. Louis, Frank B. Higgins, 924 North Sixth Street.
St. Louis, Hopmann Cornice Co., 2500–2 North Jefferson Avenue.
St. Louis, Mesker & Bro., 421-519 S. Sixth Street.
St. Louis, Missouri Fire Door Co., 100 South Commercial Street.
St. Louis, E. Murphy & Co., 3727–3731 Easton Avenue.
St. Louis, Powers & Boyd Cornice and Roofing Co., 3614–16 Laclede Avenue.
St. Louis, Richmond Safety Gate Co., 1117 Chemical Building.
St. Louis, Ruth Cornice Co., 4299 Easton Avenue.
St. Louis, St. Louis Fire Door Co., Cass and Collins Streets.
St Louis, E. E. Souther Iron Co., 2206 North Second Street.
St. Louis, Standard Fire Door and Contracting Co., 3025 Texas Avenue.
St. Louis, Van der Au & Cluss Mfg. Co., 2408 So. Jefferson Avenue.
St. Louis, Wand & Niehaus, 3008 Kossuth Avenue.
St. Louis, West End Cornice Works, 4740 Delmar Avenue.
St. Paul, Perkins Mfg. Co., Corner Fairview and University Avenues.
Toledo, O., The L. F. Burdick Co., 2011 Adams Street.
Toledo, O., J. L. Creswell, 120 N. St. Clair Street.
Toledo O., Warnke Bros. Co.
Toronto, Ont., Can., Douglas Brothers, 124 Adelaide Street, West.
Toronto, Ont., Can., A. B. Ormsby, Ltd., 161–165 Queen Street, East.
West New York, N. J., A. J. Ellis.

Metal Fire Doors and Shutters.

Three-inch fire door, made of No. 24 U. S. gage crimped galvanized iron, in horizontal sections 8 inches wide, filled with mineral fibre.

Doors of this type shown by tests and examinations conducted by Underwriters' Laboratories to be the equivalent of the standard 2 1-2-inch fire door for openings **not exceeding 80 square feet in area** and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by stamping in the plates or attaching brass labels, as shown above.

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Philadelphia, David Lupton's Sons Co., Allegheny Avenue and Tulip Street.

Metal Fire Doors.

Two and one-half-inch fire door, made of No. 26 gage steel, galvanized, in horizontal sections 8 inches wide, filled with mineral fibre. Sections tongued and grooved at intersections and held together by 1-2 inch vertical rods spaced 18 inches, passing through 2 1-2 by 1 1-2 by 3-16 inch angle at top and 1-4 by 2 1-2 inch bar at bottom of door.

Doors of this type shown by tests and examinations at Underwriters' Laboratories, Inc., to be the equivalent of the standard 2 1-2-inch tin-clad door for the protection of openings in fire walls **not exceeding 80 square feet in area**, and examined at factory and passed by Underwriters' Laboratories, Inc., are labeled by stampings in the plates or by attaching brass labels, as shown above.

The following company is equipped to supply these doors. Underwriters having jurisdiction should be consulted in all cases before installations are made.

Columbus, Ohio, Kinnear Manufacturing Co.

Door made of two thicknesses No. 22 U. S. gage corrugated galvanized sheet steel, with 1-16-inch sheet asbestos between. Corrugated steel sheets on opposite sides of door are bolted and riveted together only at edges. Doors stiffened by flat bars and galvanized iron channels at edges.

Doors of this type shown by tests and examinations conducted by the Underwriters' Laboratories to be the equivalent of the standard 2 1-2-inch fire door for openings **not exceeding six feet in width** and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by attaching brass label shown above.

The following company is equipped to supply these doors. Underwriters having jurisdiction should be consulted in all cases before installations are made.

Memphis, Tenn., Saino Fire Door & Shutter Co., Tennessee Trust Building.

Composition Fire Doors.

Two-inch solid door made of Sagax wood reinforced by ½-inch round steel rods in both directions, located in middle of door. Rods interlaced and extend close to edges of door. Vertical rods spaced not exceeding 4 inches and twisted around 1-4-inch horizontal rod at top. Horizontal rods spaced not exceeding 6 inches.

Doors of this type shown by tests and examinations conducted by the Underwriters' Laboratories to be the equivalent of the standard tin-clad door for openings **not exceeding 80 square feet in area** and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by attaching brass label shown above.

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Baltimore, Md., The Sagax Wood Co., 106 Dover Street.

Composition Fire Shutters.

One and one-half inch solid shutter made of Sagax wood, re-inforced by 1-8-inch round steel rods in both directions and a layer of expanded metal having 1 by 1-2 inch mesh. Vertical rods spaced not exceeding 9 inches and horizontal rods 11 inches apart. Reinforcing members located approximately midway between the surfaces of the door and extend to within one inch of all edges. Shutters provided with 3 hinges where in excess of 3 feet in width or 8 feet in height, and with ogee rabbet where they are made in pairs.

Shutters of this type shown by tests and examinations conducted by Underwriters' Laboratories, Inc., to be the equivalent of standard tin-clad fire shutters for the protection of exterior openings, and examined at factory and passed by Underwriters' Laboratories, Inc., are labeled by attaching brass labels as shown above.

The following company is equipped to supply this device. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Baltimore, Md., The Sagax Wood Co., 106 Dover Street.

Double Steel Rolling Fire Doors.

For openings not exceeding 8 feet wide and 9 feet high where standard fire doors cannot be employed.

Doors examined at factory and passed by Underwriters' Laboratories, Inc., have labels attached to the bottom bar reading:

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Columbus, O., Kinnear Mfg. Co., Marking, "Abacus No. 3."

Steel Rolling Fire Shutters.

For exterior openings not exceeding 10 feet wide and 10 feet high.

Shutters examined at factory and passed by Underwriters' Laboratories, Inc., have labels attached to the bottom bar as shown above.

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Columbus, O., Kinnear Mfg. Co., Marking, "Abacus No. 4."

CORRIDOR OR PARTITION DOORS

Not for Openings in Fire Walls.

Doors shown by tests and examinations conducted by Underwriters' Laboratories, Inc., to possess sufficient fire retardant value to warrant approval in corridors and partitions but **not for openings in fire walls** (see list of Fire Doors and Shutters) and examined at factories and passed by Underwriters' Laboratories, Inc., bear etched brass labels attached to the back edge reading: (See Cut No. 1.)

The following companies are equipped to supply these devices in the types indicated:

Metallic Doors.

Bradford, Pa., American Metal Door Co. 1¾-inch door, frame, trim.
Chicago, Knisely Bros., 5th Avenue and 28th Place. 2-inch door, frame, trim.
Chicago, Voigtmann & Co., 445–449 West Erie Street. 2-inch door, frame, trim.
Jamestown, N. Y., Art Metal Construction Co.
Jamestown, N. Y., Dahlstrom Metallic Door Co. 1½-inch door, frame, trim.
Minneapolis, Northwestern Roofing, Cornice & Stamping Works, 1113 S. Fifth Street. 2-inch door, frame, trim.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 1 13-16-inch door. Door only.
New York, John W. Rapp, 1 Madison Avenue. 1¾-inch door, frame, trim.
Youngstown, O., General Fireproofing Co. 2-inch door, frame, trim.

Metal Clad Doors.

Chicago, Knisely Bros., 5th Avenue and 28th Place. 2-inch door only.
Minneapolis, Thorp Fireproof Door Co., 1600–1616 Central Avenue. 1⅝-inch door, frame, trim.
Minneapolis, Thorp Fireproof Door Co., 1600-1616 Central Avenue. 2⅛-inch door, frame, trim.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 1⅝-inch door only.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 2⅛-inch door only.
New York, Howell & Lawrence, 1788 First Avenue, 1¾-inch door only.
New York, Manhattan Fireproof Door Co., 412-422 E. 125th Street. 1⅝-inch door only. Known as "Standard A."
New York, Manhattan Fireproof Door Co., 412-422 E. 125th Street. 1⅞-inch door only. Known as "Standard B."

Composition Doors.

Baltimore, Md., Sagax Wood Co., 106 Dover Street. 1¾-inch door and frame. Known as "Perfection."

STAIR OR ELEVATOR DOORS

Not for Openings in Fire Walls.

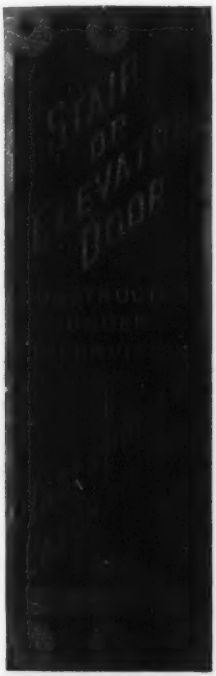
Doors shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by labels screwed or riveted to the edge of the door reading: (See Cut No. 2.)

The following companies are equipped to supply these devices:

Bradford, Pa., American Metal Door Co.
Chicago, Knisely Bros., 28th Place and 5th Avenue.
Chicago, Variety Mfg. Co.

Chicago, Voigtmann & Co., 445–449 West Erie Street.
Columbus, O., The Kinnear Mfg. Co.
Jamestown, N. Y., Art Metal Construction Co.
Jamestown, N. Y., Dahlstrom Metallic Door Co.
Minneapolis, Northwestern Roofing, Cornice and Stamping Works, 1113 S. Fifth Street.
Minneapolis, Thorp Fireproof Door Co., 1600–1616 Central Avenue.
New York, J. F. Blanchard Co., Broadway and 23d Street.
New York, Howell & Lawrence, 1788 First Avenue.
New York, Manhattan Fire Proof Door Co., 412–422 E. 125th Street.
New York, John W. Rapp, 1 Madison Avenue.
New York, Jas. G. Wilson Mfg. Co., 3 W. 29th Street.
Youngstown, O., General Fireproofing Co.

Cut No. 1.



Cut No. 2.

DOOR AND SHUTTER HARDWARE.

Standard 3½x8-inch hardware for sliding doors only, shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by approved name and issue mark on each piece in the set and by labels applied to each hanger, binder and stay roll reading as follows:

A tag is also attached to one hanger of each set on which is printed a list of the pieces which a complete set should contain, as follows:

1. One 3½x⅝-inch track, length to be equal to twice the width of the door opening, plus 21 inches. Punched for wall bolts. 2. Two hangers for openings six feet and less in width; three hangers for openings wider than six feet. Bolts for attaching hangers to door. 3. Two 3½x⅜-inch binders. 4. One 2½x½-inch stay roll. Stay roll should be the type specified for the form of sill used and should include all bolts except wall bolts. 5. One cast-iron bracket for each track bolt. 6. Two ¾x¼-inch half oval chafing strips for back of door, two 1x⅛-inch flat strips for front of door opposite the oval strips. Bolts for fastening above strips together through door. Length of above strips to be 4 inches less than door opening. 7. One 1½x⅛-inch strip 5 inches less than width of door to take wear of stay roll. Wood screws for attaching. 8. One wedge with screws for attaching. 9. One bow-shaped handle and one flush pull with bolts and screws for attaching. 10. One front bumper and one back bumper. 11. Four bumper shoes and screws for attaching. 12. One washer for each wall bolt, including those for binders and stay roll. 13. One instruction card for mounting.

Where the hardware for a single fire door on each side of the fire wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length vary in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following companies are equipped to supply this hardware:

Aurora, Ill., Richards Mfg. Co. Marking, "Monarch A."
Aurora, Ill., Wilcox Mfg. Co. Marking, "Wilcox 501 A."
Cleveland, O'Donnell Safety System Co., Corner Superior Avenue and 31st Street, N. E. Marking, "O'Donnell A."
Chicago, Variety Mfg. Co., Carroll and Sacramento Avenues. Marking, "Variety A."
Holyoke, Mass., Coburn Trolley Track Mfg. Co. Marking, "Coburn A."
Newburyport, Mass., Victor Mfg. Co. Marking, "Victor A."
New York, The McCabe Hanger Mfg. Co., 425–427 W. 25th Street. Marking, "'A' McCabe."
Philadelphia, Jas. Peters & Son, 1934–38 N. Front Street. Marking, "Peters A."
Richmond, Richmond Safety Gate Co. Marking, "A. Richmond."
South Milwaukee, Wis., Stowell Manufacturing & Foundry Co. Marking, "No. 20–A Wilbern."
St. Louis, Mesker & Bro., 421-519 South Sixth Street. Marking, "Mesker & Bro. 'A'."

. . . . . .

Specially designed malleable iron hardware for sliding fire doors, which is considered to be the full equivalent of the 3½x⅝-inch steel hardware made in accordance with the requirements of the National Fire Protection Association and examined at factories and passed by Underwriters' Laboratories, Inc., may be distinguished by approved name and issue mark on each piece in the set and by labels applied to each hanger, binder and stay roll as shown above.

A special tag is attached to one hanger of each set on which is printed a list of the pieces which a complete set should contain, as follows:

1. One 1 7-16-inch tubular track, length to be equal to twice the width of door opening, plus 14 inches. 2. Two hangers for openings six feet and less in width, three hangers for openings wider than six feet, and bolts for attaching hangers to door. 3. Two malleable iron binders. 4. One malleable iron stay roll. 5. Brackets to carry track, including two special end supports. 6. Two ¾x¼-inch half oval chafing strips for back of door, two flat strips for front of door opposite the oval strips. Bolts for fastening above strips together through the door. Length of above strips to be 4 inches less than door opening. 7. One 2¼x⅛-inch strip 5 inches less than width of door to take wear of stay roll, with wood screws for attaching. 8. One malleable iron wedge with screws for attaching. 9. One bow-shaped handle and one flush pull with bolts for attaching. 10. One front bumper and one back bumper. 11. Four bumper shoes and screws for attaching. Note: Each bumper shoe made in two pieces. 12. One washer for each wall bolt, including those for binders, bumpers and stay roll.

Where the hardware for a single fire door on each side of the fire wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length vary in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following companies are equipped to supply this hardware:

Chicago, Allith Manufacturing Co., Taylor Street and 43d Avenue. Marking, "Allith A-06."
Hamilton, Can., Allith Mfg. Co. Marking, "Allith H."

. . . . . .

Specially designed malleable iron hangers, tubular steel track and malleable iron brackets for sliding fire doors, which are considered to be the full equivalent of 3½x⅝-inch steel hardware made in accordance with the requirements of the National Fire Protection Association, approved in combination with the balance of the set of standard 3½x⅝-inch steel hardware and examined at factory and passed by Underwriters' Laboratories, Inc., can be distinguished by approved name and issue mark on each piece in the set and by labels applied to each hanger, binder and stay roll as shown above.

A special tag is attached to one hanger of each set on which is printed a list of pieces which a complete set should contain, as follows:

1. One 1¾-inch tubular steel track, length to be equal to twice the width of the door opening plus 14 inches. 2. Two hangers for openings six feet and less in width; three hangers for openings wider than six feet. Bolts for attaching hangers to door. 3. Two 3½x⅜-inch binders. 4. One 2½x½-inch stay roll. Stay roll should be the type specified for the form of sill used, and should be provided with all bolts except wall bolts. 5. Malleable iron brackets for carrying track, including two special end supports, which are also designed to act as front and back bumpers, respectively. 6. Two ¾x¼-inch half oval chafing strips for back of door; two flat strips for front of door opposite chafing strips. Bolts for fastening strips together through door. Length of above strips to be 4 inches less than door opening. 7. One 1⅜x⅛-inch strip 5 inches less than width of door to take wear of stay roll. Wood screws for attaching. 8. One wedge with screws for attaching. 9. One bow-shaped handle and one flush pull with bolts for attaching. 10. Four bumper shoes and screws for attaching. [Note: Each bumper shoe made in two parts.] 11. One washer for each wall bolt, including those for binders, bumpers and stay roll. 12. One instruction card for mounting.

Where the hardware for a single fire door on each side of the fire wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length vary in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following company is equipped to supply this hardware:

Aurora, Ill., Wilcox Manufacturing Co. Marking, "Wilcox No. 645."

. . . . . .

Hardware for metal fire doors filled with mineral fibre, which is considered to be the full equivalent of the 3½x⅜ inch steel hardware made in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., may be distinguished by labels applied to each hanger, binder and stay roll of each set, as shown above.

A special tag is attached to one hanger of each set, on which is printed a list of the pieces which a complete set should contain, as follows:

1. One 3½x⅜-inch track, length to be equal to twice the width of the door opening, plus 21 inches. Punched for wall bolts. 2. Two hangers for openings six feet and less in width; three hangers for openings wider than six feet. Bolts for attaching hangers to doors. 3. Two 3½x⅜-inch binders. 4. One 2½x½-inch stay roll. 5. One cast iron bracket for each track bolt. 6. Two ¾x¼-inch half oval chafing strips for back of door. Length of strips to be four inches less than door opening. 7. One 1½x⅛-inch strip to take wear of roller guide, provided with 3/16-inch counter-sunk holes spaced 5½ inches apart. 8. One cast-iron wedge with machine screws for attaching. 9. One bow-shaped handle, and one flush pull with 2¾-inch cap screws and two ¾-inch counter-sunk machine screws for attaching. 10. One front bumper and one back bumper. 11. Two binder shoes and machine screws for attaching. 12. One washer for each wall bolt, including those for binders and stay roll.

Where the hardware for a single fire door on each side of the wall is bolted together through the wall the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length varies in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following company is equipped to supply this hardware:

Columbus, Ohio, Kinnear Manufacturing Co. Marking, "Kinnear A."

HANGERS ONLY.

Specially designed adjustable malleable iron hanger for sliding fire doors. Approved only in combination with a complete set of approved fixtures for sliding doors, and in locations where an adjustable hanger is acceptable to Underwriters having jurisdiction. Hangers examined at factory and passed by Underwriters' Laboratories, Inc., may be distinguished by approved name and issue mark and by labels shown above.

The following company is equipped to supply this hardware:

South Milwaukee, Wis., Stowell Manufacturing & Foundry Co. Marking, "Wilbern No. 4A."

EXTINGUISHER, Miscellaneous.

Waggoner Sanatory Fire Bucket.

This pail as submitted complied with the National Fire Protection Association rules in details of construction and was designed in a manner which effectually protects its contents from evaporation and foreign matter.

Where it is desired to protect the contents of exposed pails against freezing by the addition of calcium chloride or other salts Underwriters having jurisdiction should be consulted.

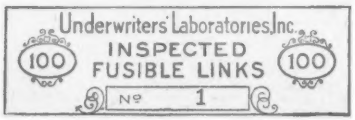
The following company manufactures this bucket:

Chicago, Ill., Waggoner Sanatory Fire Bucket Co., 1340 West Lake St.

FIRE DOORS. (See Doors and Shutters.)

FUSIBLE LINK.

Links examined at factory and passed by Underwriters' Laboratories, Inc., may be distinguished by labels attached to each box of 100 links, sealing the box, reading as follows:



The following manufacturer is equipped to supply this device for use in connection with automatic closing devices for doors and windows, and automatic devices requiring fusible links where the loads to which the links are subjected do not exceed the following:

5 lbs. where a factor of safety of 5 is required.
6 1-4 lbs. where a factor of safety of 4 is required.
8 1-3 lbs. where a factor of safety of 3 is required.

Chicago, Voigtmann & Co., 445-449 W. Erie Street.

GLASS. (See Wired Glass.)

HARDWARE. (See Door and Shutter Hardware; also Window Hardware.)

HEAT INSULATING COVERINGS.

Cork Board (Nonpareil) Laid in Cement Mortar.

This material is approved for heat insulating purposes for walls, floors and ceilings in cold storage warehouses, cold storage cellars in breweries, cold rooms in packing houses, hotel refrigerators, fur storage rooms and rooms of this character.

The following company manufactures same:

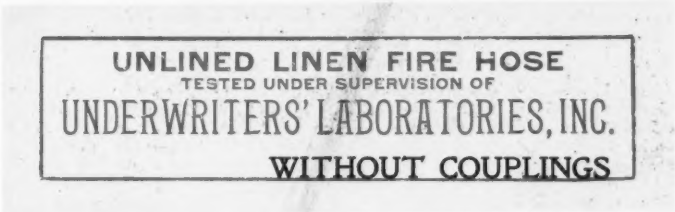
Pittsburg, Pa., Armstrong Cork Co.

HOSE.

Unlined Linen Hose.

Unlined Linen Fire Hose for use inside buildings shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by label attached to each length with couplings attached reading as follows:

And by label attached to each length **without couplings** reading:



The following companies are equipped to supply this material:

Boston, Mass., Boston Woven Hose and Rubber Co.
Lawrence, Mass., Wm. and Chas. Beck.
Malden, Mass., Chas. Niedner's Sons Co., 10–20 James Street.
New York, Eureka Fire Hose Mfg. Co., 13 Barclay Street.

HYDRANTS.

The hydrant manufactured by the following company has been examined and tested and pending the adoption of revised specifications for construction of devices of this class is recommended for use in connection with mill yard and other private underground fire mains. Service record generally satisfactory.

Indian Orchard, Mass., Chapman Valve Mfg. Co.

PAINTS, FIRE RETARDANT.

These coatings for wood and other similarly combustible building materials which come under this class, or property so coated, should in no sense be considered as "fireproof." Their use is preferable to leaving the material uncoated, because they retard the spread of fire over combustible surfaces and are particularly desirable in lieu of varnish, shellac, or oil finish, which latter serve to rapidly spread fire. Attention is called, however, to the need of renewal of the coatings in order to maintain the desired conditions.

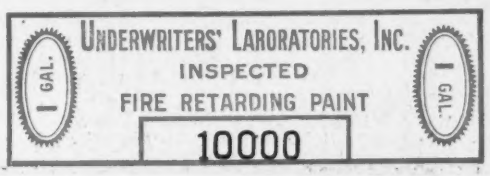
Whitewash so well meets the requirements of this class that we print formula recommended by the Lighthouse Board of the United States Treasury Department as follows:

"Slake one-half bushel of unslaked lime with boiling water, keeping it covered during the process; strain it and add a peck of salt dissolved in warm water; three pounds of ground rice, put in boiling water and boil to a thin paste; one-half pound powdered Spanish whiting and a pound of clear glue dissolved in hot water; mix these well together and let the mixture stand for several days. Keep the wash thus prepared in a kettle or portable furnace and when used put it on as hot as possible with painter's or whitewash brushes."

Where possible the coatings should be applied by a hand brush rather than by a spraying machine, thus effecting a better surface, and special care should be exercised not to coat sprinkler heads where installed.

Bay State Brick and Cement Coating. Manufactured by Wadsworth, Howland & Co., 82–84 Washington Street, Boston, Mass.

This coating is put up in cans and barrels and sold as a ready-mixed paint. The product examined at the factory and passed by Underwriters' Laboratories, Inc., can be distinguished by label attached to each container reading as follows:



The so-called "cold water" paints listed below have been examined and tested.

Alabastine. Manufactured by the Alabastine Co., Grand Rapids, Mich.
Asbestine. Manufactured by The Muralo Co., New Brighton, S. I., N. Y.
Carey's. Manufactured by The Neptune Paint Co., Hudson, Mich., for The Philip Carey Mfg. Co., Cincinnati, O.
Decorine. Manufactured by Benj. Moore & Co., 401–409 N. Green Street, Chicago.
Fox Interior Permanite. M. Ewing Fox & Co., 136th Street and Rider Avenue, New York, N. Y.
Indeliblo. Manufactured by The Muralo Co., New Brighton, S. I., N. Y.
Indurine. Manufactured by The Muralo Co., New Brighton, S. I., N. Y.
J. M. Manufactured by The Neptune Paint Co., Hudson, Mich., for H. W. Johns-Manville Co., Milwaukee, Wis.
Monarch. Manufactured by Geo. Fletcher & Co., 324 N. Ashland Avenue, Chicago.
Nepolite. Manufactured by The Neptune Paint Co., Hudson, Mich.
Retardo. Manufactured by Benj. Moore & Co., Chicago, for Retardo Fire Proof Paint Co., Milwaukee, Wis.
U. S. G. United States Gypsum Co., Chicago.

PLAY PIPE.

The National Standard Play Pipe for 2½-inch hose manufactured by the following manufacturer has been examined and tested and approved for use:

New York, Eureka Fire Hose Manufacturing Co., 13 Barclay Street.

PUMP GOVERNOR.

The "Boardman" pump governor for control of National Standard Steam Fire Pumps has been examined and tested and approved for use.

The following company manufactures the device:

Salem, Mass., Locke Regulator Co.

ROOFINGS.

Certain proprietary roofings listed below have been examined and tested.

These tests indicate that the fire retardant properties of these materials are inferior to those of slate, metal or good tin-clad roofs, but in a class with those of good slag and good gravel roofs, and superior to those of wooden shingle roofs.

Armco (Prepared, 2 ply), All Roofing Manufacturing Co., East St. Louis, Ill.
Arrow Brand Asphalt Ready Roofing (Prepared, 2 ply), Asphalt Ready Roofing Co., 136 Water Street, New York.
Amatite (Prepared), Barrett Manufacturing Co., 17 Battery Place, N. Y.
Amazon Ready Roofing (Prepared, 2 and 3 ply), Barrett Mfg. Co., Philadelphia. Pa.
Becker Asphaltum Ready Roofing (Prepared, 2 and 3 ply), F. Becker Asphaltum Ready Roofing Co., 1510-12 Milwaukee Avenue, Chicago, Ill.
Black Diamond (Prepared, 2 and 3 ply), Barrett Mfg. Co., 17 Battery Place, N. Y.
Brooks Brand Asbestos (Prepared, 3 and 4 ply), H. W. Johns-Manville Co., 100 William Street, New York.
Carbonite (Prepared, 2 and 3 ply), The Heppes Co., 4500 Filmore Avenue, Chicago.
Carey's Standard Magnesia Flexible Cement (Prepared), The Philip Carey Mfg. Co., Lockland, Cincinnati, O.
Climax Asphalt (Prepared, 2 and 3 ply), McHenry-Millhouse Mfg. Co., South Bend, Ind.
Congo (Prepared, 2 and 3 ply), The Buchanan-Foster Co., 504 West End Trust Bldg., Philadelphia, Pa.
Crystalite (Prepared), National Roofing Co., Tonawanda, N. Y.
Diamond Grit (Prepared), National Roofing Co., Tonawanda, N. Y.
Eclipse Rubber (Prepared), Ford Manufacturing Co., Washington and Desplaines Street, Chicago, Ill.
Ehrets (Slag), Warren-Ehret Co., 1202 Land Title Bldg., Philadelphia.
Elaborated Ready (Prepared), Elaborated Ready Roofing Co., 4419 La Salle Street, Chicago.
Elaterite (Prepared), Western Elaterite Roofing Co., 841–4 Equitable Building, Denver, Col.
Flexo (Prepared, 2 and 3 ply), The Heppes Co., 4500 Filmore Avenue, Chicago.
Ford (Prepared, 3 ply), Ford Manufacturing Co., 2335-2341 La Salle Street, Chicago.

Gal-va-nite (Prepared), Union Roofing and Mfg. Co., St. Paul, Minn.
Galvanized Rubber (Prepared), Ford Manufacturing Co., Washington and Desplaines Streets, Chicago, Ill.
Genasco (Prepared, Smooth Surface, 2 and 3 ply, Stone Surface, Whitestone and Model, 2 ply), The Barber Asphalt Paving Co., Philadelphia, Pa.
Granite (Prepared), The Eastern Granite Roofing Co., 1 Hudson Street, New York, N. Y.
Huttig Rubber (Prepared, 2 and 3 ply), Barber Asphalt Paving Co., for Huttig Mfg. Co., Muscatine, Iowa.
Indruroid (Prepared, 2 and 3 ply), H. F. Watson Co., Erie, Pa.
Liberty (Prepared), National Roofing Co., Tonawanda, N. Y.
Lonabond (Prepared), Rubbertex Cloth & Paper Co., Commercial National Bank Bldg., Chicago.
Malthoid (Prepared, 2 and 3 ply), The Paraffine Paint Co., Merchants' Exchange Bldg., San Francisco, Cal.
Mastic (Prepared), National Mastic Roofing Co., San Francisco, and National Roofings and Materials Co., Edwardsville, Ill.
Mikado (Prepared, 2 and 3 ply), J. A. & W. Bird & Co., 35 India Street, Boston.
Monarch (Prepared, 2 and 3 ply), Stowell Mfg. Co., Jersey City, N. J.
National (Prepared), National Roofing Co., Tonawanda, N. Y.
No-Tar (Prepared, 2 and 3 ply), The Heppes Co., 4500 Filmore Avenue, Chicago.
Paroid (Prepared, 2 and 3 ply), F. W. Bird & Son, East Walpole, Mass.
Protection Brand Asphalt Ready Roofing (Prepared), Asphalt Ready Roofing Co., 136 Water Street, New York.
Reliance (Prepared, 2 and 3 ply), Sall Mountain Asbestos Mfg. Co., 7 North Canal St., Chicago.
Rex Flintkote (Prepared, 2 and 3 ply), J. A. & W. Bird & Co., 35 India Street, Boston.
Rhinoceros (Prepared, 2 and 3 ply), Warren Chemical and Manufacturing Co., 17 Battery Place, New York.
Roofbestos (Prepared, 2 and 3 ply), Roofbestos Mfg. Co., St. Louis, Mo.
Roofrite (Prepared), The Lehon Co., W. 43rd Street, Lincoln to Robey, Chicago.
Rubber (Prepared, 2 and 3 ply), The General Roofing Co., East St. Louis, Ill.
Rubbertex (Prepared, 2 and 3 ply), The Heppes Co., 4500 Filmore Avenue, Chicago.
Ruberoid (Prepared, 2 and 3 ply), Standard Paint Co., 100 William Street, New York.
Safety (Prepared), National Roofing Co., Tonawanda, N. Y.
Security (Prepared), National Roofing Co., Tonawanda, N. Y.
Sparkloid (Prepared, 2 and 3 ply), National Roofing Co., Tonawanda, N. Y.
Standard (Prepared), National Roofing Co., Tonawanda, N. Y.
Standard Asbestos (Prepared), H. W. Johns-Manville Co., 100 William Street, New York.
Stonehenge, Asphalt Ready Roofing Co., 136 Water Street, New York, N. Y.
Stowell's Slag (Slag), Stowell Mfg. Co., Jersey City, N. J.
Texaco Felt (Prepared, 2 and 3 ply), The Texas Company, Houston, Texas.
Usona Burlap Center Asphalt Roofing (Prepared), Usona Mfg. Co., Aurora, Ill.
Usona Gravel Surfaced (Prepared), Usona Mfg. Co., Aurora, Ill.
Usona Pebble Top Asphalt Roofing (Prepared), Usona Mfg. Co., Aurora, Ill.
Veribest Rubber (Prepared, 2 and 3 ply), McHenry-Millhouse Mfg. Co., South Bend, Ind.
Vulcanite (Prepared, 2 and 3 ply), The Patent Vulcanite Roofing Co., 1283 S. Campbell Avenue, Chicago.
Walrus (Prepared, 2 and 3 ply), Warren Chemical and Manufacturing Co., 17 Battery Place, New York.
West Coast Ready Rock (Prepared), The West Coast Company, Waukegan, Ill.
X-L-Oid Rubber Roofing (Prepared, 2 and 3 ply), Keystone Roofing Mfg. Co., York, Pa.

Shingles.

Winthrop Asphalt Shingles, Winthrop Asphalt Shingle Co., Chicago. **Rated as ordinary wooden shingles.**

SASH CHAIN. (See Window Hardware.)

SASH LOCK. (See Window Hardware.)

SHUTTERS. (See Doors.)

SPRINKLERS, Automatic.

The following patterns are approved:

Crowder, Issue A., Crowder Bros., 309 Merchants-Laclede Bldg., St. Louis, Mo.
Grinnell Improved 1903. General Fire Extinguisher Co., Providence, R. I.
International, Issue B. International Sprinkler Co., 517 Arch Street, Philadelphia, Pa.
Manufacturers, Issue C. Manufacturers' Automatic Sprinkler Co., 1–11 Liberty Street, New York.
Neracher Improved 1902. General Fire Extinguisher Co., Providence, R. I.
Niagara-Hibbard, Issue B. Niagara Fire Extinguisher Co., Akron, O.
Rockwood, Issue C. Rockwood Sprinkler Co., 4 Arch Street, Worcester, Mass.

SPRINKLER SUPERVISORY DEVICES.

For use in connection with approved central station systems.

Consists of apparatus for transmitting signals when gate valves are closed or open; when water in tanks falls below or is restored to predetermined level; when pressure in air tanks falls below or is restored to predetermined amount; when water in tanks falls below or rises above predetermined temperatures. Also apparatus for connection with water flow valves to transmit water flow signals (where there is a flow of water equal to that of one or more sprinklers) and to withhold signals from water surges or variable pressures.

A. D. T. Devices for attaching to Central Station Signaling Systems for supervisory maintenance and operation of sprinkler equipments. Manufactured by Automatic Fire Protection Company, New York and Chicago.

THERMOSTATS.

Automatic Fire Alarm Systems.

These systems utilize the principle of the expansion under heat of air contained in a small copper tube which is installed along ceilings or piping. Tube leads to contact closing and test devices of special type. The expansion of air in tube actuates a diaphragm closing an electric circuit whereby signal is transmitted.

These devices as sold by the following companies are **approved** subject to the following conditions:

1. Underwriters having jurisdiction to be consulted in all cases before installations are made.
2. Tubing to be installed to comply as to location, distribution and spacing with requirements for thermostats of electric automatic fire alarms.
3. Central station equipments, local equipments, electric devices and circuits and other portions of this system other than the tubing and the pneumatic devices connected with it to comply in all respects with the requirements for similar portions of automatic fire alarm systems.
4. Labels. Tubing for this system constructed according to approved specifications and examined and tested at factory under the supervision of Underwriters' Laboratories, Inc., bears tag reading: "Underwriters' Laboratories, Inspected Tubing for Automatic Fire Alarm, No. . . . . ." One such tag for each length of tubing installed should be preserved in transmitter case at risk as permanent record of tubing used. Each Detector, Annunciator and Transmitter for this system constructed according to approved specifications and examined and tested at factory under supervision of Underwriters' Laboratories, Inc., bears metal label reading: "Underwriters' Laboratories, Inspected Automatic Fire Alarm Device, No. . . . . ."

Denver, Colorado. Frederick Thomas, Coronado Building, Agent for United States and Canada, for English Patentees.

"Aero" System.

New York. American District Telegraph Co., 195 Broadway, "Compensating" System.

VALVES, ALARM. (See also Sprinkler Supervisory Devices.)

No appliances meeting all of the requirements desirable for this service have as yet been shown.

Ratings covering the patterns found in common use have been issued as follows:—

Evans Variable Pressure 1902 model. Manufactured by International Sprinkler Co., 517 Arch Street, Philadelphia. Not standard. Field experience limited, but fairly satisfactory where device has been properly installed, correctly adjusted and intelligently supervised.

Grinnell English Pattern, Variable Pressure (Swing check or Straightway type). Manufactured by General Fire Extinguisher Co., Providence, R. I. Not standard. Field experience fairly satisfactory where device has been properly installed, correctly adjusted and intelligently supervised.

Grinnell branch (old type called Harkness Tee). Manufactured by General Fire Extinguisher Co., Providence, R. I. Not standard. Field experience, where central station and Local Board supervision obtains and valves are under constant pressure, reported as fairly satisfactory.

Manufacturers. Manufactured by Manufacturers' Automatic Sprinkler Co., 1–11 Liberty Street, New York. Not standard. Field experience with an improved type of this valve in one locality, where central station and Local Board supervision obtains and valves are under constant pressure, reported as fairly satisfactory.

Niagara. Manufactured by Niagara Fire Extinguisher Co., Akron, O. Not standard. Field experience with an improved type of this valve in one locality, where central station and Local Board supervision obtains and valves are under constant pressure, reported as fairly satisfactory.

VALVES, DRY PIPE.

The following dry pipe valves are approved for use:—

Grinnell Straightway, 4, 5 and 6-inch sizes. The General Fire Extinguisher Company, Providence, R. I.

International (No. 4 Evans Model), 4-inch and 6-inch sizes. International Sprinkler Co., Philadelphia, Pa.

Manufacturers (Model 3), 4-inch and 6-inch sizes. Manufacturers' Automatic Sprinkler Co., New York, N. Y.

Niagara (1909 Model), 4-inch and 6-inch sizes. Niagara Fire Extinguisher Co., Akron, O.

Rockwood, 4-inch and 6-inch sizes. Rockwood Sprinkler Co., Worcester, Mass.

WATCHMEN'S TIME RECORDING APPARATUS.

Users of the following Time Recording Apparatus should in all cases consult local Underwriters having jurisdiction concerning the particular type of appliance or system to be used, the number and location of stations, character and installation of wiring, methods to be followed in receipt and disposition of signals, keeping of records, rendering reports, and all other details having a bearing on proper installation, maintenance and use.

The label is evidence of proper construction of the devices at the factories.

Boxes for Central Station Systems.

Combined Watchmen's Call and Fire Alarm Boxes for use in connection with approved normally closed circuit Central Station Watchmen's Time Recording Apparatus, shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the rules of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by labels fixed to the outside of the clock cases reading:—

The following companies are equipped to supply these devices:

Baltimore, Viaduct Electric Co., 10 S. Howard Street.
Milwaukee, Signalphone Company.
New York, American District Telegraph Co., 195 Broadway.
Washington, The Williams Company, Stewart Building.

Apparatus for Local or Private Systems.

Watchmen's Time Recorders shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with the rules of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by labels fixed to outside of clock cases reading:

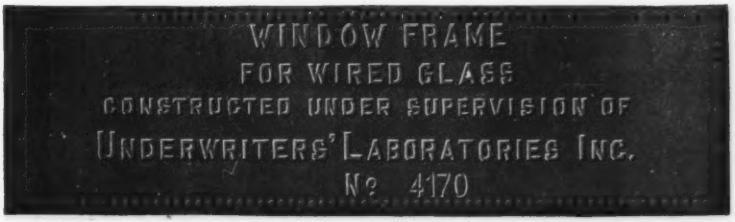
and a decalcomania transfer is applied to the outside of the clock station cases reading:

The following companies are equipped to supply these devices of the types listed below:

Boston, Eco Magneto Clock Co., 289 Congress Street. Stationary with magnetos, circular dial and cylindrical dial types. Portable.
Boston, E. Howard Clock Co., 373 Washington Street. Stationary with magnetos, circular dial and cylindrical dial types.
Brookline, Boston, Holtzer-Cabot Electric Co. Stationary with magnetos, circular dial.
Chicago, Newman Clock Co., 1526 Wabash Avenue. Stationary, single station type. Portable.
Chicago, The Timekeeper Co., 1524 Wabash Avenue. Portable.
Chicago, Hardinge Bros., 3135 Lincoln Avenue. Portable, double dial and single dial types with plunger keys; single dial type with steel key.
Cleveland, American Watchman's Time Detector Co., 2069 Fourth Street. Stationary with magnetos, circular dial types.
Gardner, Mass., Simplex Time Recorder Co. Stationary with magnetos, cylindrical dial type.
Grand Rapids, Mich., E. A. Hamilton & Co. Stationary with magnetos, circular dial type.
New York, American Watchman's Time Detector Co., 234–5 Broadway. Stationary with magnetos, circular dial type.
New York, General Watchman's Time Detector Co., 27 Pine Street. Portable.
New York, E. O. Hausberg, 45 Maiden Lane. Stationary with magnetos, circular dial type. Portable.
New York, Nanz Clock Company, 178 Fulton Street. Portable.
New York, Standard Watchman's Time Detector Co. (W. Romaine), 1-3 West Broadway. Stationary with magnetos, circular dial type.

WINDOWS.

Metallic Window Frames and Sash for Wired Glass shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., have metal labels riveted to the inside of the window, reading:



The following companies are equipped to supply these devices:

Atlanta, Ga., Dowman-Dozier Mfg. Co., 605 Rhodes Bldg. Double Hung.

Baltimore, Md., The C. D. Pruden Co., Warner, Dock and Bayard Streets. Double Hung; Pivoted Upper.

Boston, Mass., E. B. Badger & Sons Co., 63 Pitts Street. Double Hung, Stationary (2 types); Pivoted Upper Sash; Pivoted Upper and Lower Sash; Pivoted Lower Sash; Single Pivoted Sash; Pivoted Upper and Double Hung Lower Sash.

Boston, Mass., E. Van Noorden Co., 944 Massachusetts Avenue. Double Hung; Pivoted Upper Sash; Single Pivoted Sash.

Brooklyn, N. Y., Herrmann & Grace, 671–685 Bergen Street. Pivoted Upper Sash; Pivoted Upper and Lower Sash; Pivoted Lower Sash; Stationary.

Buffalo, N. Y., Machwirth Bros., 201–209 Oak Street. Pivoted Upper Sash; Pivoted Upper and Lower Sash.

Chicago, Ill., Grace Cornice Works, 1260 Indiana Avenue. Double Hung; Pivoted Upper Sash; Pivoted Upper and Lower; Single Pivoted; Stationary.

Chicago, Ill., Illinois Roofing & Cornice Co., 1144–1146 Kinzie Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Top Hinged Sash.

Chicago, Ill., Knisely Bros., Fifth Avenue and 28th Place. Double Hung; Stationary; Casement; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Top Hinged Sash; Single Pivoted Sash.

Chicago, Ill., H. C. Knisely & Co., 506–508 S. Canal Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Top Hinged; Top Hinged Upper and Stationary Lower; Twin Pivoted; Twin Stationary; Twin Hinged; Twin Double Hung; Three Pivoted; Stationary Upper and Lower, Pivoted Middle; Pivoted Upper Sash and Two Stationary.

Chicago, Ill., J. C. McFarland & Co., 27th Street and Fifth Avenue. Double Hung; Stationary; Casement; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Top Hinged; Top Hinged Upper and Stationary Lower Sash.

Chicago, Ill., James A. Miller & Bro., 114–116 S. Clinton Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Top Hinged.

Chicago, Ill., Perkinson & Brown, 413–415 N. Lincoln Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Top Hinged Sash; Twin Double Hung Sash; Twin Stationary Sash; Stationary Lower and Top Hinged Upper.

Chicago, Ill., E. A. Rysdon & Co., 527 W. 41st Street. Double Hung; Pivoted Upper Sash; Stationary; Pivoted Lower; Upper and Lower Sash Pivoted, Middle Sash Stationary; Top Hinged; Stationary Lower, Top Hinged Upper.

Chicago, Ill., Sykes Steel Roofing Co., 19th Place and Sangamon Avenue. Double Hung; Stationary (two types); Pivoted Upper (two types); Pivoted Lower Sash (two types); Pivoted Upper and Lower Sash (two types); Single Pivoted Sash (two types); Top Hinged Sash; Twin Pivoted Upper Sash; Twin Top Hinged; Twin Double Hung Sash.

Chicago, Ill., Voigtmann & Co., 445–459 Erie Street. Double Hung; Stationary; Casement; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Three Pivoted Sash; Three Sash, Upper and Lower Stationary, Middle Pivoted; Twin Pivoted Sash; Top Hinged; Top Hinged Upper and Stationary Lower; Twin Pivoted Sash; Twin Stationary Sash.

Chicago, Ill., W. D. Watson Co., 1037 Van Buren Street. Pivoted Upper and Lower Sash; Single Pivoted.

Cincinnati, Ohio, The Edwards Mfg. Co., Eggleston Avenue, 4th and 5th Streets. Double Hung; Pivoted Upper Sash.

Cincinnati, Ohio, Jacob Freund Roofing Co., B. & O. S. W. Ry., near Mitchell Avenue. Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Cincinnati, Ohio, Thomas Lee, 128 W. Second Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Hinged.

Cincinnati, Ohio, Witt & Brown, 215 West 3d Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Cleveland, Ohio, Ohio Roofing Co., 1477 Euclid Avenue. Double Hung.

Cleveland, Ohio, Riester & Thesmacher Co., 1514–1526 W. 25th Street. Double Hung (two types); Counter Balanced; Pivoted Upper Sash (two types); Stationary; Pivoted Lower Sash; Single Pivoted Sash.

Columbus, Ohio, F. O. Schoedinger, 146–148 North 3d Street. Double Hung.

Detroit, Mich., W. J. Burton Co., 164–166 West Larned Street. Double Hung.

Galveston, Texas, Texas Sheet Metal Works, 2624–2626 Mechanic Street. Double Hung.

Hoboken, N. J., Leonard Sheet Metal Works, 215–221 Grand Street. Double Hung; Pivoted Upper Sash.

Kansas City, Mo., Monarch Metal Mfg. Co., 1722 Tracy Avenue. Pivoted Upper Sash; Pivoted Upper and Lower; Single Pivoted; Stationary.

Kansas City, Mo., J. A. Ritzler Cornice & Ornament Co. Double Hung; Pivoted Upper Sash.

Kansas City, Mo., Henry Weis Cornice Co., 4124-4138 E. 12th Street. Double Hung; Stationary; Pivoted Upper Sash (two types); Pivoted Upper and Lower Sash (two types); Single Pivoted Sash (two types); Pivoted Lower Sash; Single Top Hinged Sash; Twin Pivoted; Twin Stationary; Twin Double Hung.

Kansas City, Mo., Zahner Mfg. Co., 310–316 West 20th Street. Double Hung (two types); Stationary (two types); Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Hinged.

Lebanon, Pa., C. Bressler & Co. Double Hung.

Louisville, Ky., J. F. Wagner & Sons, 1145–1149 Seventh Street, near Oak. Double Hung; Pivoted Upper Sash; Pivoted Lower Sash; Single Pivoted Sash; Pivoted Upper and Lower Sash; Stationary.

Los Angeles, Cal., California Cornice Works, 1610–1614 San Fernando Street. Double Hung.

Milwaukee, Wis., Biersach & Niedermeyer Co., 216–220 Fifth Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Milwaukee, Wis. Consolidated Sheet Metal Works, 661–673 Hubbard Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Top Hinged; Twin Double Hung Sash; Twin Hinged Sash: Twin Pivoted Sash; Hinged Upper and Stationary Lower.

Minneapolis, Minn., Selden Roofing & Mfg. Co., 76 Western Avenue. Double Hung.

Minneapolis, Minn., Stremel Bros. Roofing and Cornice Co., 1215–1219 Washington Avenue, East. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

New Orleans, La., American Sheet Metal Works, Carrollton Avenue and Edinburgh Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted; Twin Stationary.

New Orleans, La., A. J. Nelson Mfg. Co., Howard Avenue and Dryades Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash: Single Top Hinged.

New Orleans, La., New Orleans Roofing and Metal Works, Scott, Toulouse, St. Louis Streets and Carrollton Avenue. Double Hung.

New York, N. Y., J. F. Blanchard Co., Fuller Building, Broadway and 23d Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted; Stationary.

New York, N. Y., The Geo. Hayes Co., 71 Eighth Avenue. Pivoted Upper Sash.

New York, N. Y., Voigtmann & Co., 427 W. 13th Street. Double Hung (two types); Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Three Pivoted Sash; Two Pivoted and Stationary Lower Sash; Stationary Lower and Top Hinged Upper; Top Hinged; Counterbalanced.

New York, N. Y., M. F. Westergren, Inc., 213–221 E. 144th Street. Double Hung; Pivoted Upper Sash; Pivoted Upper and Lower Sash.

Philadelphia, Pa., David Lupton's Sons Co., Allegheny Avenue and Tulip Street. Double Hung; Casement; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Top Hinged Sash Opening in; Top Hinged Sash Opening out; Twin Pivoted Sash; Twin Double Hung Sash.

Philadelphia, Pa., The J. S. Thorn Co., 20th and Allegheny Avenue. Double Hung; Casement; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Counter-balanced Sash.

Pittsburg, Pa., Keighley Metal Ceiling & Mfg. Co. Double Hung; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Three Pivoted Sash; Stationary.

Pittsburg, N. S., Pa., Allegheny Cornice & Skylight Co., 821 Boquet Street. Double Hung; Twin Double Hung.

Pittsburg, N. S., Pa., Thos. W. Irwin Mfg. Co., 401-411 Rebecca Street. Double Hung.

Pittsburg, Pa., Rasner & Dinger Co. Double Hung.

Salem, O., W. H. Mullins Co. Double Hung (two types); Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted; Three Pivoted; Stationary.

San Antonio, Tex., T. P. Walsh, 739 E. Houston Street. Double Hung.

San Francisco, Cal., Forderer Cornice Works, corner Potrero Avenue and 16th Street. Double Hung (two types); Pivoted Upper Sash (two types).

San Francisco, Cal., Rulofson Metal Window Works, 315–319 Monadnock Building. Double Hung; Pivoted.

San Francisco, Cal., San Francisco Cornice Works, Bryant between 9th and 10th Streets. Double Hung; Pivoted Upper Sash; Double Pivoted; Single Pivoted.

St. Louis, Mo., Eagle Metal Works Co., 1510–1512 Clark Avenue. Double Hung; Pivoted Upper.

St. Louis, Mo., Hopmann Cornice Co., 2571–2573 Benton Street. Double Hung.

St. Louis, Mo., Mesker & Bro., 421–519 S. Sixth Street. Double Hung; Stationary; Casement; Vertical Pivoted; Pivoted Upper Sash; Double Pivoted; Single Pivoted; Top Hinged; Double Hung Lower Sash with Stationary Transom; Double Hung Lower Sash with Hinged Transom; Double Hung Lower Sash with Pivoted Transom; Casement Sash with Stationary Transom; Casement Sash with Hinged Transom; Casement Sash with Pivoted Transom.

St. Louis, Powers & Boyd Cornice and Roofing Co., 3614–3616 Laclede Avenue. Double Hung.

St. Louis, John F. Ruth Cornice Works, 4298 Page Avenue. Double Hung.

St. Louis, Von Der Au & Cluss Mfg. Co., 2404–2408 South Jefferson Avenue. Double Hung.

St. Paul, St. Paul Roofing and Cornice Co. Double Hung.

Toronto, Ont., Douglas Bros., Ltd., 128 Adelaide Street N. Double Hung.

WINDOWS, Hardware.

Sash Locks.

Malleable iron locks examined at factory and passed by Underwriters' Laboratories, Inspectors have attached to each box of **twelve locks,** sealing the box, label reading as follows:

The following manufacturers are equipped to supply these devices:
Chicago, Payson Manufacturing Co., 2918 Jackson Boulevard.
New Haven, Conn., The H. B. Ives Co., 11–17 Artizan Street.

Gravity Locks.

Malleable iron locks examined at factory and passed by Underwriters' Laboratories' Inspectors have attached to each box of **three locks,** sealing the box, label reading as follows:

The following manufacturers are equipped to supply these devices:
Philadelphia, Pa., Jas. Peters & Son, 1934–1938 North Front Street.

Gravity Locks and Pivots.

Fire window hardware examined at factory and passed by Underwriters' Laboratories' Inspectors have attached to each box of three (3) sets, sealing the box, reading as follows:

The following manufacturers are equipped to supply these devices:
Newark, N. J., Frank F. Smith, 19 Division Street.
New York, N. Y., J. W. Yates, 156 Ninth Avenue.

Sash Chains.

The following sash chains in the sizes indicated have been examined and tested and are approved for use on metallic window frames and sash with wired glass as follows:

Community Guaranteed Sash Chain. Oneida Community Limited, Oneida, New York.

Size No. 80 for sash weighing not more than 90 pounds.
Size No. 100 for sash weighing not more than 120 pounds.
Size No. 130 for sash weighing not more than 160 pounds.
Size No. 250 for sash weighing not more than 210 pounds.

Hot Galvanized Steel Sash Chain, looped type. Bridgeport Chain Co., Bridgeport, Conn.

Size No. 1 for sash weighing not more than 80 pounds.
Size No. 2 for sash weighing not more than 130 pounds.
Size No. 3 for sash weighing not more than 195 pounds.

WIRED GLASS.

It has not been judged necessary to extend label service to this material up to the present time. Distinctive marks applied by the companies themselves to that portion of their product constructed in accordance with the standard (without constant supervision of such marking by the Laboratories) has been considered acceptable.

New York, N. Y. Mississippi Wire Glass Co.

This company claims exclusive right to the use of hexagonal mesh in wired glass. Decision of the Court of Last Resort on this claim is not yet obtained. In the meantime substandard wired glass using hexagonal mesh is occasionally found on the market. Members should therefore make careful inspection of this type of product before acceptance.

Philadelphia, Pa. Continuous Glass Press Co.
Marking: Consists of a strand of the wire mesh made by twisting two No. 27 gage wires together, and spacing such distinctive cabled strand approximately 10 inches apart in each sheet of glass manufactured.

Pittsburg, Pa. Arbogast-Brock Glass Co.
Marking: A U-shaped piece of wire, 3-16 of an inch in height, embedded near one corner or spaced about 15 inches apart vertically and horizontally in each light.

Streator, Ill. Western Glass Co.
Marking: Consists of five loops at each vertical strand of wire mesh.

Washington, Pa. Highland Glass Co.
Marking: Consists of a double strand of wire at intervals of 9½ inches. The two wires of the double strand are not twisted together except at the twisted portions of the mesh.

For Use in Connection with Burglar Alarm Equipments.

New York, N. Y. Mississippi Wire Glass Co., for American District Telegraph Co., 195 Broadway.

One-fourth inch wired glass with series of parallel wires about ½-inch apart, approximately midway between surfaces. Designed for use in connection with burglar alarm equipments. Submitted as possessing some value as fire retardant.

When mounted in standard window frames with lights not in excess of 720 square inches and with neither dimension in excess of 48 inches, this glass is approximately 50 per cent as efficient as standard wired glass for protection against moderate exposure.

Oilcloth and Linoleum Works---Fire Record.

Total number of fires, 60.

1. CLASSIFICATION OF CAUSES.

Common Causes.

LIGHTING. Number of fires, 1.

Fire caused by the upsetting of a kerosene oil lamp in printing department.

HEATING. Number of fires, 0.

POWER. Number of fires, 1.

Overheating or spark from motor ignited waste or combustible material nearby.

BOILER (or fuel). Number of fires, 0.

RUBBISH (or sweepings). Number of fires, 1.

Spontaneous combustion in a barrel of sweepings in printing and drying room.

OILY MATERIAL. Number of fires, 0.

SMOKING. Number of fires, 1.

Employee struck match to light pipe and ignited benzine vapors.

LIGHTNING. Number of fires, 4.

LOCOMOTIVE SPARKS. Number of fires, 0.

MISCELLANEOUS. Number of fires, 1.

Spark from tinsmith's furnace ignited roof.

Special Hazard Causes.

CORK GRINDING. Number of fires, 7.

Fire caused by foreign substance passing through grinder or grinding stones striking together.

Piece of metal passing through grinding machine with cork struck fire.

Foreign substance in stock in cork grinder.

Friction in cork grinding machine.

Spark in grinding machine ignited cork.

Fire occurred in a bag of cork from grinding machine, probably from a smouldering spark.

Spark from a broken metal screw conveyor ignited fine dust.

OIL AND VARNISH BOILING. Number of fires, 4.

Boiling linseed oil in a large kettle heated by coal, fumes ignited from open fire.

Boiling oil which had a very low flash point. Vapors ignited from open fire underneath kettle.

Overheated varnish-still exploded.

Linseed oil boiling. Water accidentally sprayed into kettle, causing same to boil over and ignite from fire underneath.

OIL OXIDIZING. Number of fires, 2.

Spontaneous combustion in thinly coated cheese-cloth.

Spontaneous combustion in oxidizing building.

PAINT AND COATING COMPOUND MIXING. Number of fires, 4.

Truck ran over match on floor, igniting benzine vapors from mixing tubs.

Paint mixing machines had been cleaned with benzine. Vapors were ignited by watchman's lantern.

Benzine was added to oilcloth coating compound before same was sufficiently cool, which ignited the benzine.

Spontaneous combustion of ground linseed oil and gums piled in wooden trays.

COATING AND VARNISHING. Number of fires, 12.

Spark from static electricity or foreign substance at spreading knife ignited coating.

Static electricity at spreading knife of coating machine ignited fresh coating of paint.

Static electricity in varnishing machine ignited vapors.

Static electricity ignited benzine vapors from varnish.

Static electricity in coating machine, 8 fires.

LINOLEUM AND OILCLOTH DRYING. Number of fires, 17.

Linoleum or oilcloth falling on steam pipes and igniting, 5 fires.

Spontaneous combustion of stock in dry room, 3 fires.

Spark of static electricity, caused by pulling cloth from coating machine over wire netting of drying rack, ignited the fresh coating of paint.

Started in drying rack while running cloth into rack and flashed out into coating machine.

Occurred in drying rack filled with freshly coated stock.

Unknown in drying rack or room, 6 fires.

MISCELLANEOUS. Number of fires, 1.

Watchman in making his round through varnishing room struck pail of varnish with his lantern, igniting same.

Summary.

Common Causes.

	No. of Fires	Per Cent of Whole
Lighting	1	1.8
Heating	0	.0
Power	1	1.8
Boiler (or fuel)	0	.0
Rubbish (or sweepings)	1	1.8
Oily material	0	.0
Smoking	1	1.8
Lightning	4	7.1
Locomotive spark	0	.0
Miscellaneous	1	1.8
Total	9	

Special Hazard Causes.

	No. of Fires.	Per cent. of Whole.
Cork grinding	7	12.5
Oil and varnish boiling	4	7.1
Oil oxidizing	2	3.6
Paint and coating compound mixing	4	7.1
Coating and varnishing	12	21.4
Linoleum and oilcloth drying	17	30.4
Miscellaneous	1	1.8
Total	47	
Common Causes	9	16
Special Hazard Causes	47	84
Total	56	
Incendiary	0	
Exposure	0	
Cause Unknown Fires	4	
Total Oilcloth and Linoleum Works Fires	60	

2. DETAILS OF CAUSES.

Common Causes.

H-1403. Tinsmiths had been repairing roof and had left only a short time before fire was discovered on roof. Fire evidently was caused by spark or heat from tinner's furnace.

S-2110. Fire was caused by spontaneous combustion in a barrel of sweepings left in the printing and drying building contrary to orders.

S-8195. Dry-room was in operation and fan running. Fire was evidently caused by the overheating of motor or spark igniting waste or other combustible material nearby. The floor directly above the motor was partially burned and the motor and starting box badly damaged.

Special Hazard Causes.

S-326. Room in which fire occurred was occupied for the printing and varnishing of oilcloth and linoleum. A linseed oil varnish thinned with benzine was used, a considerable quantity of which was kept in pails in room during working hours but which was removed at night.

On this night a partially filled pail had been left in the room. The watchman had an ordinary tubular lantern and he accidentally struck the pail with it in passing, splashing the varnish up close to flame and igniting vapors. The blaze immediately flashed to the ceiling, opening one sprinkler which checked the fire.

S-1474. The coating for oilcloth at this mill is made by mixing boiled linseed oil, clay colors and benzine. Fire was caused by employees attempting to thin the linseed oil with benzine before the oil was sufficiently cool, the benzine vapors igniting with a flash.

S-2091. Fire was caused by friction in coating machine and spread into drying rooms. The light wooden drying racks furnished a large amount of highly combustible material for fire and burned more fiercely than the oilcloth in process of drying. Since fire racks have been reconstructed of iron pipe.

S-2170. Fire was apparently caused by a piece of linoleum breaking and falling on steam pipes near the floor in drying room. Watchman saw no evidences of fire while passing through room twenty minutes before, and claims to have seen no linoleum down. Dryer building was about three-quarters full of coated linoleum and coated or painted burlap, hung in festoons 45 feet high.

H-2638. Fire occurred in a one-story brick joisted building, used for cement making. The cement consisted of ground linseed oil, that is, linseed oil which has been well oxidized and ground in coarse mills and is in a semi-pulpous state, rosin, kauri gum and other gums. The foreman in charge was taken suddenly ill and failed to order the wooden trays removed from building, as is customary. The ground oxidized linseed oil gradually heated up and the following day ignited the wooden trays in which it was piled.

Building was well detached from main plant and fire was easily extinguished in about twenty minutes.

S-2813. Fire was discovered just inside drying room in a piece of coated burlap as it came from the coating machine into the rack. Paint used in coating the burlap contained a considerable proportion of benzine and the vapor from this was probably ignited either by a spark of frictional electricity or a piece of grit or sand going under coating knife. Both knife and iron drying racks are well grounded and any electricity should be cared for.

At the time racks contained only twelve to fifteen layers of cloth, so that there was a space of about seven feet to sprinklers and ceiling. On discovering fire, the valves controlling perforated pipes were opened, alarm given, and the private brigade of the works applied three hose streams, extinguishing fire in about ten minutes. City department responded, but did no work. Sprinklers opened promptly and assisted in confining fire.

The twelve or fifteen layers of freshly coated burlap were badly burned, part being completely destroyed, but the iron racks and iron covered ceiling, together with the quick application of water, prevented fire from getting a hold on building except in one place just outside dry-room doors, joists being only slightly scorched at this point. The rack three feet distant from one in which fire occurred contained 35 layers of freshly coated burlap; this was not scorched. A small water loss on stock in lower floors resulted.

With the wooden racks formerly in this building and open joist ceiling, a fire generally went through about two floors, as well as destroying the roof before being controlled.

S-3388. Static electricity at spreading-blade of coating machine caused spark, igniting vapors from the paint on the freshly coated cloth passing through machine to drying room. Spreading-blade was not grounded.

H-3833. Room in which fire occurred is occupied for the grinding and mixing of paints. The machinery consists of six iron mixing tubs, three grinding mills and three rolling mills. This floor was also used for the storage of pigments.

The rolling mills are cleaned every afternoon with benzine. On the day of fire mills had been cleaned as usual and plant shut down at 5 P. M. Shortly after six o'clock watchman in making his rounds entered this building, carrying an ordinary lantern of the railroad type burning lard oil. Entering this room, he had reached about the center when an explosion occurred some ten or fifteen feet ahead of him near one of the rolling mills but apparently in an open space. After the explosion flame burst from the mixing tubs and containers of paints, etc., which were nearby.

The primary cause of the explosion is conjectural. It is possible that the watchman's lantern ignited the benzine vapors in the air, the vapor spreading fire to other machines and paint containers, although watchman states he saw no flames around or near lantern.

The fire consumed a large part of the paints in the room, the woodwork on machinery, belting, etc.

H-3986. Fire occurred in building occupied for the bolting and mixing of ground cork, being caused by the breaking of a metal screw conveyor in the bottom of a bolting machine. The broken conveyor screw struck one of the metal supports of the machine, causing a spark which ignited the fine cork dust in the bolter.

A brief resume of the process of cork grinding at this plant is as follows: The raw cork material is granulated clean cork, received in bales compressed under heavy pressure, which lessens considerably the inflammability of the cork, as there are practically no air spaces in these bales.

This cork is stored in detached frame sheds, where it is screened and blown to the grinding building. Blower ducts in grinding building are provided with pockets to catch heavy or foreign material in the scrap cork. Grinding is done by Ross stone mills, water-cooled on the discharge vents. The dust from the grinders is blown through metal ducts to the adjoining bagging room, the end of the ducts being open so as to allow a vent for any explosion that may occur.

After bagging, the bags of cork dust are allowed to cool in another building. The dust as it leaves the mills is highly heated, and if not carefully tended would ignite.

H-4304. Fire occurred in oil boiling house caused by either the boiling over of the linseed oil or the fumes from same igniting from the coal fires. Oil was being boiled in two large kettles heated by coal fires. The fire rapidly spread and ignited the contents of the kettle and burned until contents were consumed.

Building was of fire-resistive construction, brick walls, with the excep-

tion of east wall which was constructed of corrugated metal on iron studding. Roof was of corrugated metal on iron supports. The oil was a total loss; the building damage was very slight.

S-5431. Fire occurred at 12.30 P. M. in the unsprinklered linseed oil and varnish boiling building. This was a one and two story brick building of fire-resistive construction. The two sections were separated by a twelve-inch brick wall, with one opening protected by a poor tin-clad fire door which was open at the time of fire.

In the one-story section was a portable kettle of three-barrel capacity; in the first story of the two-story section there was one three-barrel capacity portable kettle and one ten-barrel capacity stationary kettle which extended to second floor. Linseed oil was being boiled in the large kettle at time of fire and had attained a temperature of probably 650 degrees when an explosion occurred, blowing out the light glass windows in the second floor. The fire then ignited stock in kettles and metal storage tank in two-story section, also igniting the skylight frames over both sections.

Owner states the usual temperature reached in boiling the oil is between 500 and 550 degrees, and with heavy oil such as was being boiled in the large kettle, about 600 degrees. This was the first time the large kettle had been used for boiling the heavy oil requiring the high temperature, it having been the custom to use the smaller kettles for this purpose. In order to liberate the gases generated in the process of boiling, it is necessary to stir the oil continuously, but when the workmen saw oil was getting too hot they ceased stirring and attempted to draw fire from under kettle, the explosion occurring before they could accomplish this.

S-5775. Drying cell or room in which fire occurred was 100 feet long, fourteen feet wide and 50 feet high. Cell was constructed of brick walls, concrete floor; roof, plank on unprotected steel frame. The printed or varnished cloth was hung in festoons about 45 feet high.

At the time fire occurred cell was almost full of freshly painted or varnished stock, varnishing machine was at opening into cell and practically the last length of cloth was being run in. There was considerable varnish, mostly benzine, in the machine, and this varnish and stock at the end of cell ignited almost simultaneously.

Fire was probably caused by a spark of static electricity igniting the benzine vapors either at machine or at point where cloth was being drawn into drying room. Forty-six sprinklers opened and practically extinguished the fire. Loss to building slight; stock damaged about $1,500.

S-5926. Fire was undoubtedly caused by a spark of static electricity igniting vapors from the coating mixture. This might either have occurred at the coating mill where the burlap passes under coating knife or by friction of the cloth on wooden drying racks. Coating knife was of steel and said to be well grounded.

The burlap was receiving the first coat or backing of paint and color containing benzine as a thinner, and after passing under steel coating knife to remove excess paint was being drawn into the wooden drying racks when the vapors ignited, fire spreading over machine and rack.

After the fire was extinguished, superintendent examined the grounds on coating knife and found wires intact and connections apparently perfect. Seventeen sprinklers opened and held fire in check, loss being mostly on stock.

S-6951. One of the tenter bars supporting oilcloth became displaced and allowed cloth to fall on a live steam pipe near floor, which generated sufficient heat to ignite it. The cloth was hung in long folds directly over the unprotected steam coils.

S-7832. The cork grinders are located on the first floor, the ground cork being formerly elevated from the grinder to the second floor by means of a screw conveyor. A short time ago a cyclone separator was installed in the roof house and a blower system arranged to carry the cork from the grinders to the cyclone, where the dust and air were separated, the dust falling by gravity to the second floor.

A spark was evidently struck from a nail or some metal substance going through the grinder, the fire being carried up the pipe to the cyclone where it exploded the dust.

The top of the cyclone was bulged out from the force of the explosion and a flash of fire spread through the room, opening six sprinklers, which immediately extinguished the fire. No damage was done to the building, the ceiling being only slightly blackened; and water does not injure the stock.

Owners have discontinued the use of the cyclone and have gone back to the screw conveyor, claiming that the conveyor is always full and chokes back an explosion, confining it to the grinder, where it does no more harm than to blow the cover off.

3. ROOMS IN WHICH FIRE OCCURRED.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Storage and non-manufacturing	2	22	1	2	2	67	5	8
Motor and fan room	1	11	..	..	..	..	1	2
Oil boiling house or room	..	..	4	9	..	..	4	7
Oil oxidizing building	..	..	2	4	..	..	2	3
Cork grinding	1	11	6	13	..	..	7	12
Coating compound mixing	..	..	4	9	..	..	4	7
Coating and drying	4	44	28	60	1	33	33	56
Printing department	1	11	..	..	..	..	1	2
Varnishing	..	..	2	4	..	..	2	3
Total with data given	9		47		3		59	
No data	0		0		1		1	
Total	9		47		4		60	

4. DAY OR NIGHT FIRES. (Day Fires 6 a. m. to 6 p. m.)

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Day	3	33	35	76	..	..	38	64
Night	6	66	11	24	4	100	21	36
Total with data given	9		46		4		59	
No data	0		1		0		1	
Total	9		47		4		60	

5. PLANT IN OPERATION.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Plant in operation .	5	56	35	74	..	..	40	66
Plant not in operation	4	44	12	26	4	100	20	33
Total with data given	9		47		4		60	
No data	0		0		0		0	
Total	9		47		4		60	

6. HOW DISCOVERED.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Employee	4	50	35	76	..	..	39	67
Watchman	4	50	11	24	4	100	19	33
Thermostat	..	..	..	..	..	..	..	..
Sprinkler Alarm .	..	..	..	..	..	..	..	..
Outsider	..	..	..	..	..	..	..	..
Total with data given	8		46		4		58	
No data	1		1		0		2	
Total	9		47		4		60	

SPRINKLER FIRE RECORD.

7. EFFECT OF SPRINKLERS.

	No. of Fires.	Per Cent of Whole.
Extinguished or practically extinguished fire	14	33
Held fire in check	16	38
Unsatisfactory	12	28.6
Total	42	
No claim	8	19
Small loss	21	50
Large loss	13	31
Total	42	

8. DETAILS OF UNSATISFACTORY SPRINKLER FIRES.

132. June 24, 1898. The fire started in the south end of building No. 4. This was a large room about 90 by 70 feet and 95 feet high, filled with painted linoleum hanging from ceiling in festoons, and separated from north end of building by a frame partition, north end being filled with painted or varnished oilcloth laid flat in racks which badly obstructed the sprinklers.

The cause of the fire is unknown, but thought to be of incendiary origin. From this building fire spread to adjoining buildings occupied for the printing, coating and drying of linoleum and oilcloth, destroying six buildings in all and part of boiler house.

Buildings were of brick, joist construction, and were equipped with Walworth single and double link sprinklers on wet system supplied by two large gravity tanks, giving eight and one-half pounds pressure on sprinklers first opened, and two automatic steam pumps. Pipe sizes were old standard 1-3-6, or slightly better. Spacing and arrangement about ten by eight or nine feet.

Watchman discovered fire at 11 P. M., while in nearby building, having passed through building where fire occurred at 10.50 P. M. Outside watchman also discovered fire at about the same time, and immediately gave alarm. Employees nearby responded, and engineer at once started the two Deane steam pumps. Employees applied two hose streams, but found them of no effect, as fire was burning too fiercely, so turned their efforts to saving adjoining buildings. The first steamers responding to alarm draughted from the 100,000 gallon reservoir, which also supplied fire pumps, the others attaching to hydrants. The water in reservoir lasted until about 11.40, when the walls of three of the buildings fell out across the railroad tracks, filling the reservoir with debris, wrecking the pump house, and demolishing several buildings. Engineer states that 65 pounds pressure was held on pump, although pumps were supplying sprinklers

and two hose streams. The sprinklers in an adjacent building checked fire in that portion of the mill buildings, sprinkler heads being opened by employee.

The fire was hot, quick and very disastrous, the buildings being a total loss. The fire started in the drying building filled with painted or varnished oilcloth hanging in festoons, and laid in racks which seriously obstructed sprinklers. The sprinklers also were located at too great a distance above racks to give efficient protection. The large number of sprinklers opened under the light pressure must have reduced the water supply and pressure to practically nothing at the start. A total of 1,300 heads in all opened. Loss approximately $200,000.

Summary: Severe hazard and light water pressure from antiquated sprinkler system.

984. May 22, 1900. Fire was discovered by employee in coating room on third floor at 1 P. M., evidently caused by a spark of static electricity at coating machine, igniting vapors from paint. Fire spread from coating mixture into drying racks. Coating and drying building was constructed of brick walls, single floors, open joist ceilings.

Building was equipped with Walworth pendant double link sprinklers installed in 1888. Sprinklers were on wet system supplied by city waterworks, 30 pounds pressure on sprinklers on third floor. Secondary supply was from a steam pump. Pipe sizes were old standard 1-3-6, all sprinklers on third floor being fed through a six-inch riser. There was a line of sprinklers over each rack, and lines between racks at sides.

As soon as fire was discovered alarm was given, and private brigade, assisted by brigade from neighboring mill, applied fourteen hose streams to fire. Public department responded at once, and in all thirty to thirty-six hose streams were turned into the third story.

At the time fire started cloth was being run into the drying racks from coating machine, and there were three or four large open tubs of mixed paint on floor near machine. This made a quick, hot fire, opening all sprinklers in the room—160 in all. While the sprinklers were undoubtedly of great assistance, and helped to save the building, they could not reach seat of fire on account of the severe obstruction to distribution from the oilcloth in drying racks, and the sprinklers and piping on third floor were mostly destroyed by the heat, showing the severity of the fire. The large amount of water used drowned out the fire, and confined it to the third floor. The roof and contents of third floor were a total loss, but below the third floor there was little damage to building, although the water damage to stock was considerable. No sprinklers were opened on the first or second floors. Loss large.

Shortly after public department went into action the fire pump broke down, crippling the private protection to some degree. Six hose lines were laid from neighboring plant.

Summary: Severe hazard, obstruction to distribution.

1256. March 30, 1901. Fire occurred on the third floor of the coating and drying building at 1.30 P. M., being caused by spontaneous com-

bustion in a roll of freshly coated cloth on spindle of coating machine before same had been run through paint and under knife. Flames burst from the roll of cloth, igniting paint tank, and following freshly coated goods into dry room. Fire was discovered, and alarm given by employee, sprinkler alarm being disconnected.

Building was three stories in height, brick walls, joist construction. Third floor contained a coating room 33 feet long, and width of building at one end. A wooden partition with six large openings closed by sliding doors opposite end of drying racks separated this from the drying room 92 feet long, and open the width of building. At the rear of drying room there was another frame partition across room, forming a passway nine feet wide. This whole floor was practically one large room, and susceptible to one fire.

Room was equipped with Grinnell glass disc 286 degrees pendant sprinklers, installed in 1900. Room contained 146 sprinklers, all of which opened. Pipe sizes were old standard, 1-3-6, wet system, supplied by city water, 28 pounds pressure, and steam pump. Sprinklers were spaced nine by eight feet, and nine by six feet, not staggered, and were arranged so there was a line of sprinklers at each edge of cloth, and over the middle. Room was also equipped with a three-inch perforated pipe in front of partition between coating and dry room. This was fed from the six-inch riser supplying the sprinklers, as were also the two hose connections on this floor. The 500 gallon Worthington pump was kept shut off from sprinkler mains by an outside gate valve, which was opened on receipt of alarm of fire supplying hose streams and sprinklers.

The employee at machine claims to have pulled valve opening perforated pipe, and then attacked fire with chemical extinguishers, fire pails and a two-inch hose stream. Public fire department responded at once. The private brigade from neighboring mill assisted, using several streams from their private hydrants. Twelve hose streams were used, and fire controlled in about an hour.

The sprinklers operated at once, but failed to hold the fire in check, this due to the severe hazard of burning oilcloth and obstruction from the oilcloth in racks, the dry room being nearly full at the time. It is also probable that the water supply to sprinklers was considerably overtaxed on account of the large number of sprinklers opened, the hose streams and perforated pipe all supplied by the one six-inch riser.

The damage to building was considerable. The roof, with the exception of about twenty feet at one end, was completely destroyed, the stock in dry room was destroyed, and a large amount of stock on floors below heavily damaged by water. The columns on top floor were burned off, but the floor boards were only slightly charred in a few places, owing to the amount of water on the floor. Loss approximately $14,000.

Summary: Severe dry room hazard and obstruction to distribution.

2092. April 19, 1902. At about 10.25 A. M. fire started from friction or foreign substance in coating on burlap passing under spreading knife and being drawn from coating mill into drying rack in the fourth

story of coating and drying building. In this dry room a perforated pipe system had been installed in addition to the sprinklers, but both systems were evidently of little service except to wet the floor, and the fourth story was burned out in about the same manner as in the fires Nos. 984 and 1256. The owner, having lost confidence in sprinklers after the second fire, installed a system of large-sized perforated pipes in the drying racks, with direct connection to the six-inch sprinkler riser for supply. Lever-handled valves were provided in each branch line with strong iron rods and bell-cranks attached within easy reach of the coating mill operator, the idea being to flood the upper or last layer of cloth that had been drawn into the racks (fires generally starting on that one) before sufficient heat was generated to fuse sprinklers.

The valves of the perforated pipe system were all found open after the fire and all of the 146 sprinklers in the fourth story that could be found were fused, as were several in the third story. The sprinklers were spaced very closely, with branch lines in all the racks and alleyways.

The water pressure from city main was about 45 pounds at the ground level, and a pressure of 100 pounds from the fire pump was put on the sprinkler mains immediately after the fire was discovered, and it is reported that the supply was ample for sprinklers and perforated pipes.

Several lines of mill-yard hose were brought into service, and the fire was extinguished by aid of the public department, two alarms being sounded.

The highly inflammable nature of the stock, and the light, wooden racks in the drying room seemed to make it impossible to promptly check the fire, and it is suggested that the process of coating, as done in this building, should be isolated in a one-story building, and that the drying racks should be built of iron. Loss $15,345.

Summary: Severe hazard and obstruction to distribution.

2441. May 20, 1903. Fire started at 6.45 A. M. in the third and fourth floors of No. 4 building. This was practically a detached four-story building, 30 feet west of No. 3 and of open joist ceiling, single floors, brick wall construction. The main part of all floors was used for drying printed oilcloth. Fire was discovered by a locomotive engineer, who blew his whistle notifying watchman, who turned in alarm. Cause of fire supposed to be lightning striking sheet iron ventilator extending through and above roof over drying racks, lightning passing down ventilator and open traps to third floor. Finished oilcloth passed from the rolls of two printing machines on first floor horizontally through the drying racks, going to top floor racks through floor openings. At the time of fire racks were largely filled with cloth placed in horizontal layers. It is probable that strips of oilcloth had been left extending from machines up through floor openings, and that the lightning ran down these strips igniting two or more floors simultaneously. Fire was fought by sprinklers, hose streams and public fire department.

Sprinklers were of the Walworth soldered deflector pendant type, installed in 1889, and Grinnell glass disc pendant, installed in 1902. There were about 145 sprinklers on each floor, practically all opened. Pipes were

installed in 1889, wet system; primary supply from city waterworks, giving about 40 pounds pressure. Sprinklers were spaced approximately six feet across joists and nine feet with joists. Secondary supply consisted of a 500-gallon fire pump draughting from a well filled by a 57,000 gallon cistern and by a four-inch city inlet, which was also used for sprinklers. Pressure on sprinklers before opening about twenty-two pounds on top floor. It is probable that this pressure was reduced considerably on account of the large number of sprinklers opened, over-taxing the four-inch city connection up to the time the fire department arrived and fire pump was used on sprinklers alone.

At the time fire was discovered there were two watchmen, three firemen and about 75 employees working in this department. They at once manned hose streams and fire pump was started. A private brigade from a neighboring mill also responded. Fully fifteen minutes elapsed before the public fire department arrived on account of the remoteness. Fire pump was used to supply sprinklers and hose streams until arrival of the public fire apparatus, when it was used on sprinkler system alone until walls began to fall. Iron-clad shutters at windows on adjacent building facing fire at a distance of 30 feet, prevented fire from spreading into this building.

There is no doubt but that the sprinklers opened properly and considerably delayed the progress of the fire up to the time the walls began to fall and breaks in the main sprinkler laterals occurred. The main sections of all floors burned were taken up by frame drying racks which in themselves alone supplied a considerable amount of very combustible material.

Building and contents were a total loss, amounting to approximately $46,000.

Summary: Severe hazard and obstruction to distribution.

2784. February 17, 1904. Fire occurred at 10.30 A. M. in the four-story brick joist-constructed varnishing and coating building, being caused by a spark of static electricity in coating machine igniting benzine vapors from the coating mixture. Fire discovered and alarm given by employee.

Building was equipped with Walworth pendant sprinklers installed in 1888, spacing six by eight feet, old pipe sizes, wet system supplied by gravity tanks giving about thirteen pounds pressure on sprinklers. Second supply was from two 1000-gallon fire pumps. These were of great assistance supplying water under heavy pressure to sprinklers and hose streams.

The fire, starting in coating machine on the second floor, flashed into dry room, spreading rapidly over the freshly coated stock in racks. The sprinklers were slightly canted to one side on account of lack of space for the operation of the cloth carriers and hence were unable to distribute water evenly in a horizontal direction on all sides.

The varnish used on some grades of cloth gives off, in drying, a varnish vapor which condenses heavily on the woodwork of building, sprinkler piping, sprinklers, etc. This, however, did not seem to retard the operation of the sprinklers, although it probably reduced their sensitiveness considerably.

The factory brigade was at once called into service and put seven lines of hose into service. Fire department responded, three alarms being given,

and fire was fought for nearly two hours before final extinguishment. Water supplies were ample from four large gravity tanks and the two fire pumps draughting from reservoir.

Owing to the severe hazard and obstruction to distribution, fire burned through into the third floor, passing up into the fourth where contents and roof were destroyed. Fire was held in check on the second floor. Loss about $16,000.

Summary: Severe hazard and obstruction to distribution.

3542. January 11, 1905. Fire occurred in three story brick mill-constructed drying building at 1.30 A. M. Cause unknown. Fire was discovered by watchman while in another building, he having failed to discover it on his previous round. Clock records are unsatisfactory, and his movements on night of fire are unknown. Mill owner states that there had been considerable trouble with magnetos in dry room owing to the heat and varnish vapors, and that it was necessary to ring magneto with much vigor in order to have them register. This may have been the trouble with the clock records. The public fire alarm was out of service owing to broken wires from a sleet storm, and companies were notified as to location of fire by mill whistle.

Building was equipped throughout with Grinnell glass disc sprinklers, 1-2-3 pipe sizes, a modern equipment, but severely obstructed by stock and drying rack. Primary water supply was from an automatic pump, 75 pounds pressure, and two gravity tanks of 24,000 gallon capacity. Wet system. All sprinklers opened and failed to hold fire in check.

All supplies were exhausted within an hour after fire was discovered. Three serious defects in sprinkler equipment diminished its effectiveness, viz.: obstruction by drying racks filled with goods, hose on yard hydrants drawing from sprinkler supplies, limited suction supply for fire pump.

Stock on drying racks of this character forms as complete an obstruction to ceiling sprinklers as any type of shelving could, and equipments in these drying rooms should include lines of piping along the sides of racks, carrying sprinkler heads which would play horizontally between the sheets of goods. Loss approximately $35,000.

Summary: Obstruction to distribution, and deficient water supplies.

4156. July 15, 1905. Fire occurred at 3.25 P. M. in the dry room in a four-story brick building of joist construction with single floors occupied for the coating and drying of linoleum. Dry room was frame enclosed, 90 by 20 feet, extending from first floor to roof. There were no sprinklers in this dry room, although the rest of building was equipped. Fire started in dry room from an unknown cause, possibly a piece of linoleum falling on the steam pipes. Dry room was cut off by tin-clad partition. Fire quickly spread and was soon beyond sprinkler control. Linoleum dry room should have been equipped with sprinklers.

Summary: Unsprinklered portions.

4885. May 19, 1906. Fire occurred at 9 A. M. in building occupied for the coating and drying of linoleum and paint mixing, starting in a drying frame used at time for drying linoleum backing. Building was

equipped with Walworth improved pendant sprinklers on wet system, old standard pipe sizes and arrangement. Primary water supply to sprinklers was from gravity tanks giving about eight pounds pressure on sprinklers which first opened; second supply from a steam pump.

Sprinklers opened at once, and were probably of some value on third floor where fire started, but fire rapidly spread through holes in ceiling into floor above, and finally into fifth floor, opening so many sprinklers that water supplies were over-taxed and exhausted. The equipment was old and defective, and with the severe hazard and obstruction to distribution of a linoleum drying room fire could hardly be expected to control the fire. Loss $14,000.

Summary: Severe hazard with obstruction to distribution.

8438. March 18, 1909. Fire started on the first floor of the cork grinding building at 3.30 P. M., being caused by a spark from a piece of metal going through the grinders or the stone striking together. Building was of brick and stone construction with mill constructed floors, and equipped with Esty No. 5 sprinklers on dry system, modern pipe sizes, spacing and arrangement. Sprinklers operated promptly, and helped hold fire in check on the second floor, but owing to floor openings and chutes fire spread into roof house, spreading into concealed space back of the sheathing out of reach of the sprinklers. Fire was finally extinguished with hose streams, loss being approximately $2,500. For further details see Quarterly, Volume 3, No. 1, page 89, fire 8438.

Summary: Floor openings and concealed space.

8302. May 1, 1909. Fire occurred in drying building at 7.20 P. M., caused by stock falling on steam pipes or spontaneous combustion in the newly coated linoleum. Building was of brick and timber, construction one story, equal to four stories high. Roof two-inch plank on bay timbers. Building was divided into two sections by a twelve-inch fire wall parapetted two feet, good double fire doors at ground and also at gallery floor 45 feet above floor. Galleries were from two to three feet wide, running the length of building on east side between racks, and also a narrow gallery on west side. There was a cross gallery at the north end. These galleries were sprinklered underneath. Just under roof fire wall reduced to eight inches, and it appears that bay timbers projected deep enough into this wall to almost meet at the centre, and fire spread through one of these holes.

Each section of the building had a saw tooth skylight 30 feet long and about five feet high, located near fire wall with the raised faces glazed with thin glass looking in opposite direction.

Rooms were equipped with drying racks at gallery floor level constructed of iron pipe or rods and timber framework, linoleum being dried in festoons from these racks in length of about 44 feet Building was heated by steam pipes at floor and sides, the steam pipes at floor being protected by heavy wooden slats above the pipes.

Building was equipped with Grinnell glass disc 286 degree sprinklers on wet system, 1-2-4 pipe sizes, spaced one line in each eight-foot bay,

sprinklers eleven feet apart. System supplied by a 1,000 automatic steam pump, secondary supply a 430 gallon pump and two gravity tanks. Gravity tanks were not drawn upon during fire.

Watchman had just completed his round, pulling box in this building at 6.45 P. M., and at that time the odor of "gas" from the drying linoleum was quite noticeable, and fearing that a piece of linoleum had fallen on steam pipes, he went around dry room carefully, and found all in good condition. At 7.15 while in yard, he discovered smoke pouring out of the windows in dry room. Watchman gave alarm, and entered building to shut steam off dry room, but was not successful. On hearing the whistle employees and public fire department responded, and quickly placed hose streams in service. Fire was fought from neighboring buildings, hose streams being taken from public and private protection. Over 100 pounds pressure was held on pumps during fire.

In all, the section where fire occurred contained 30,000 square yards of goods; part of this was cork carpet, approximately one-half inch thick, and part a high grade thin cloth used for "inner soling." There was also considerable linoleum in this section.

Most of the stock either fell or was pulled down from the racks forming in piles on floor and it was necessary to take this out a piece at a time to extinguish the fire, the pile blazing up each time a layer of cloth was lifted. Fire even before this occurred was obstinate to fight and was not fully under control till the following morning.

Fire burned through a hole in fire wall where the roof timbers met as noted and spread into adjoining section of dry room. One sprinkler opened and assisted by a hose stream and three chemical extinguishers checked fire at this point,

Dry room was cut off by good single fire doors from a similar dryer on the south side and from the one story calendering room, no fire getting into these buildings.

The principal damage to building was to the roof which was considerably charred; the gallery floors were practically uninjured and the heavy frame work supporting racks was only charred in one spot, about twenty feet above floor. Roof of west section of drying building was also charred, skylight partly burned out and one roof plank burned considerably next to fire wall. Practically all the stock hanging in festoons in the east section of building, where fire originated, was so damaged that it was of no value. There was considerable dried linoleum lying on the floor ready for the hand block printers. This stock was badly damaged by water. There was also some water loss on stock in west section.

The sprinklers were of considerable assistance and undoubtedly prevented the spread of fire over entire roof. They, however, were unable to satisfactorily extinguish fire owing to the severe hazard and the severe obstruction to distribution from the long festoons of heavy linoleum. Loss approximately $30,500.

Summary: Severe hazard and obstruction to distribution.

9068. October 22, 1909. Fire occurred in the seasoning and drying room, being discovered by employee at 9.30 A. M. Cause of fire unknown, but probably due to the drying room hazard.

Room was of fire-resistive construction with concrete ceiling, equipped with Esty sprinklers, on wet system, supplied by water works, 80 to 85 pounds pressure. Secondary supplies consisted of a gravity tank and steams pumps, which were of considerable assistance during the fire. The spacing and arrangement of sprinklers were of modern design with aisle sprinklers to discharge water into drying racks between the sheets of drying linoleum. Forty sprinklers opened in dry room and three in adjoining room. These were of little value owing to the severe obstruction to distribution and although confining fire to the rack in which it originated, were not a factor in its extinguishment. The loss was total on contents of room and the iron drying racks were badly warped. Loss approximately $6,000. For further details see Quarterly No. 3, Volume 3, January, 1910, page 351, fire 9068.

Summary: Obstruction to distribution.

9. DETAILS OF LARGE LOSS SPRINKLER FIRES. (Where sprinkler control is satisfactory.)

4275. October 19, 1905. Fire occurred on the top floor of ordinary joist constructed building with open finish, occupied for the coating and drying of linoleum. It was probably caused by a spark of static electricity which was generated by the friction of the linoleum passing over the wire netting supporting divisions in rack, and was first noticed about thirty feet from coating machine at end of rack. This was about 2.45 P. M. and alarm was at once given by employees.

Room was equipped with Esty 280 degree sprinklers, on wet systems, staggered spacing, supplied by gravity tanks, nine pounds pressure on sprinklers opened and two 1,000 gallon Underwriters' steam pumps.

Employees immediately used chemical extinguishers but were soon driven from room on account of the dense smoke. As soon as the whistle sounded the fire pumps were started supplying hose streams and sprinklers. Practically no water was used from the primary gravity tank supply.

Twelve sprinklers opened and held fire in check. Fire department responded and used hose streams through holes cut in roof extinguishing fire in about two hours. After fire was out, it was found that fire damage was slight and confined to the top floor, the roof joists were charred and twelve pieces of linoleum were partly burned, Damage by water was considerable as all floors were flooded. Loss $10,500.

Summary: Obstruction to distribution.

7787. September 4, 1908. Fire occurred on second floor of two story brick mill-constructed building occupied for storage of ground cork and for rolling and mixing. Ground cork is conveyed to this floor by a screw conveyor from grinding building about thirty feet distant across alley. This apparatus was not in operation at time of fire. Cork is bagged and stored

on this floor. Employee was working at mixing machine when fire occurred in the ground cork stored nearby. Cause of fire is unknown, but probably spontaneous combustion from foreign material in the ground cork or a smouldering spark from grinders.

Room was equipped with Grinnell metal disc, issue "D" sprinklers, old standard pipe sizes, 1-3-6; good spacing; wet system, supplied by water works, 70 pounds pressure and steam pump. Pump was of service in extinguishing fire. The employees at once used a 40-gallon chemical extinguisher and three three-gallon chemical extinguishers on fire with apparently no other effect than to scatter the blazing cork dust. Thirty-two sprinklers opened and alarm was given from private box, local department responding. Meanwhile the pumps had been started and four hose streams put into use. Public department used five more streams on account of the dense smoke. Sprinklers operated satisfactorily and held fire in check, fire being extinguished in about two hours.

The damage to the building was very slight; the ceiling of the monitor skylight and part of the roof of main building only being slightly charred where the water from the sprinklers did not reach. The loss was largely from water, and the damage to stock in adjoining sections was due to the fire doors being held open to allow the use of hose streams; water passing through doors on opposite side of room wetting stock. Damage was also due to floor in one section being on a lower level and stock not being skidded; finished stock was standing on end in rolls here. Loss $7,000.

Summary: Obstructions to distribution.

10. POINTS OF INTEREST FROM FIRE REPORTS.

Alarm Service.

S-115. Watchman discovered fire at 12.24 A. M. When on his round fifteen minutes before he found everything all right at this point. Later he smelled smoke and found cork dust smouldering on rafters of roof truss. Fire caused by lightning.

S-2170. Fire discovered by watchman who had passed through drying building about twenty minutes before. On looking back towards this building he saw smoke coming from the windows and immediately gave fire alarm.

S-2172. Watchman had completed his round entering oxidizing building where fire occurred about ten minutes before discovery. He was standing in yard talking to another watchman when they saw flames in this building.

S-3542. Watchman failed to promptly discover fire. Sprinkler alarm gong on outside of building did not ring, probably owing to a recent sleet storm filling bell with ice. The same storm caused several breaks in the public fire alarm system and disarrangement of signals so that a delay of five to ten minutes was caused in arrival of fire department.

S-7427. Fire was discovered by watchman. It is not known whether sprinkler alarm operated or not. There was considerable water damage from the one sprinkler opened which had been operating for some time before discovery. Sprinkler alarm tested in order later in the day.

S-8195. Watchman passes through building every two hours on his regular round, and at 7.50 on the night of fire rang the station on the top floor where fire occurred, at this time noticing nothing unusual. At 9.30 P. M., while near the boiler house, he saw flames burst out from the top floor of the building, fire evidently having been burning for some time.

Automatic Sprinklers.

S-2170. Sprinkler heads were spaced eight by eleven feet under wooden galleries 45 feet above concrete floor. There were 75 heads in the room, 72 of which opened. Sprinklers were Grinnell 286 degrees test. These were supplied by a five-inch riser from a six-inch main. Fire was practically extinguished by sprinklers except where burning under cloth. However, the effect of fire on ceiling showed that sprinkler protection was not of the best, as is shown by the charred portions which in all cases extended to within two feet of the sprinklers. Under the joist ceilings wherever sprinklers were located directly between the joists practically not more than the space between joists was thoroughly protected. Owing to the excellent construction of the building the fire did not extend through roof.

S-5132. Fire occurred during the noon hour in the room used for the mixing of coating for the back of linoleum. There were between fifteen and twenty tubs of this coating in room. Coating is composed of mostly linseed oil, ochre and naphtha. Cause of fire unknown, but thought to have been caused by truck running over a match on floor and igniting naphtha vapors. This made a very quick, hot fire.

Five sprinklers opened and blanketed the blaze to such good effect that the employees were able to approach and smother the fire with sand. The sprinklers effectually protected the ceiling and woodwork and fire was extinguished in about fifteen minutes. No hose streams were used.

S-5775. Cell in which fire started was 100 feet long, fourteen feet wide and 50 feet high. Cloth was hung in festoons 45 feet high. This cell was equipped with eight Esty 280 degrees "Jumbo" sprinkler heads. All of these except the one at the far end opened. Fire inside cell was thought to be practically extinguished after about ten minutes, and sprinklers were shut off. The fire, however, immediately blazed up again and sprinklers were turned on for ten or fifteen minutes longer. Fire department then used hose stream, totally extinguishing fire. A portion of the stock near where fire started fell to the floor, but probably not over 20 per cent. of the stock in the cell was burned, though the edges of nearly all pieces of cloth in the dry room were scorched.

The fire ignited the benzine varnish in coating machine at opening to drying cell, causing a quick, hot fire, opening about twenty heads in the printing department. These were shut off after running about twenty minutes and fire fought with sand pails, wet blankets and chemical extinguishers. Nineteen additional heads opened after water was shut off.

S-5431. Fire occurred in the unsprinklered linseed oil and varnish boiling building, adjoining and communicating with the sprinklered boiler

and engine house. Buildings were separated from each other by a blank brick wall with the exception of one opening into boiler room protected by a two and one-half inch automatic sliding fire door. This was open at the time of the fire and failed to close. Fire spread through this opening into boiler and engine house, setting fire to the ceiling, scorching and charring the same. Thirteen sprinklers opened at this point and practically extinguished the fire.

S-5809. Fire started in varnishing machine due to static electricity igniting vapors from varnish and spread into drying rack where some 30 pieces of finished material were in process of drying.

Sprinklers were spaced two heads in each fourteen by sixteen foot bays under plank ceiling on exposed steel frame. Floor was cement, open finish brick walls. Of the 96 heads in this room fourteen opened supplied by waterworks, twenty-two pounds pressure and entirely extinguished the fire. Sprinklers in operation approximately four minutes.

Construction.

S-326. Floors in varnishing rooms were of sixteen-inch concrete, Ransome system of construction, and were supposed to be water-tight. Water, however, leaked through floor along side walls and at floor seams, principally at walls. There was a large stock of finished material on floor below, standing on end in rolls. The water from floor above caused this stock to buckle at the edges, doing considerable damage. There was no damage from fire.

S-2170. Drying building was of brick, mill construction, and was practically uninjured by the fire. About twenty pieces of linoleum fell during fire and were partially burned. Seventy-two sprinklers opened, preventing roof planks and gallery from being burned, although arrangement of sprinklers was defective.

Fire Wall.

H-4074. Fire started in two one-story buildings, equal to three ordinary stories in height, used for drying oilcloth hung in long festoons. Cause of fire unknown.

The buildings were separated by a twenty-one inch brick wall. Wall, however, did not extend to within ten feet of roof, being built up from this point with a frame, metal-clad partition. The wall was not reinforced in any way, and was apparently unable to withstand the extreme heat of such a fire. Wall collapsed when fire was well under way and both buildings were totally destroyed.

Obstruction to Distribution.

S-590. The coated oil cloth was hung in vertical loops from ceiling over steam pipes on iron racks. The racks extended above the sprinklers and seriously obstructed the discharge of water, but the cloth soon burned through and fell to the floor, allowing water from sprinklers to effectually protect the ceiling.

S-7383. Fire occurred in drying room. Two sprinklers opened and held it in check. They could not extinguish it, however, owing to the severe obstruction to distribution from the crowded condition of the room. Fire was finally extinguished with hose streams.

S-7427. Fire occurred under a low, narrow wooden bench twenty inches wide, used for hand printing of oilcloth. Cause of fire unknown, but probably spontaneous combustion of oily wiping rags. One sprinkler opened above bench and practically extinguished fire. Watchman, upon discovering fire, extinguished the remaining embers with water from fire pails. Water from this sprinkler, however, leaked through floor into stock room below, and caused considerable loss on finished stock.

Public Department.

S-590. Firemen ordered watchman to shut off sprinkler system, as they stated they could not work in the discharge of water. After water was shut off the fire immediately started up and water was turned on again, extinguishing fire with assistance of hose streams.

11. NUMBER OF SPRINKLERS OPENED.

No. of Sprinklers Operating.	Extinguished Fire. No. of Fires.	Extinguished Fire. Per Cent.	Held Fire in Check. No. of Fires.	Held Fire in Check. Per Cent.	Unsatisfactory. No. of Fires.	Total. No. of Fires.	Total. Per Cent.	No. of Sprinklers Operating.	No. of Fires.	Per Cent of Whole.
1	3	21	..	..	..	3	7	1	3	7
2	2	14	3	19	..	5	12	2 or less	8	19
3	..	..	..	..	..	..	..	3 or less	..	..
4	..	..	..	..	..	..	..	4 or less	..	..
5	2	14	..	..	..	2	5	5 or less	10	24
6 to 9 inc.	2	14	..	..	..	2	5	Less than 10	12	29
10 to 24 inc.	3	21	5	31	..	8	19	Less than 25	20	48
25 to 49 inc.	2	14	1	6	1	4	10	Less than 50	24	57
50 and over	..	..	7	44	11	18	43	50 and over	18	43
Total	14		16		12	42				

Average number of sprinklers opened, not including unsatisfactory, 37.0

12. ALARM SERVICE.

	Satisfactory. No. of Fires.	Satisfactory. Per Cent.	Failure. No. of Fires.	Failure. Per Cent.	Total.
Watchman alone	9	100	..	..	9
Sprinkler alarm alone	..	..	..	..	..
Thermostat alone	..	..	..	..	..

	Watchman. Satisfactory.	Watchman. Failure.	Sprinkler Alarm. Satisfactory.	Sprinkler Alarm. Failure.	Thermostat. Satisfactory.	Thermostat. Failure.	Total.
Watchman and sprinkler alarm	4	..	3	1	..	..	4

NOTE. — These tables do not include fires where alarm service does or does not operate properly if fire is at once discovered by employee, the alarm service having no bearing on such fires one way or the other.

13. SECONDARY WATER SUPPLIES.

590. Primary water supply from waterworks, 50 pounds pressure on sprinklers first opened. Secondary supply from steam pump. Eighty sprinklers opened and held fire in check, pump being used for sprinklers and hose streams, giving good service.

984. Primary water supply, waterworks, 40 pounds pressure. Secondary supply from a small steam pump. A large number of sprinklers opened and the pump was of little service.

2091. Primary supply, waterworks, twenty-five pounds pressure. Secondary supply from steam fire pump. One hundred eleven sprinklers opened and pump was of great value, assisting in holding fire in check.

2092. Primary supply was from waterworks, 45 pounds pressure. Secondary supply from a 500-gallon steam fire pump. A large number of sprinklers opened and pump was used on sprinklers and yard hydrants.

2784. Primary supply was from four gravity tanks, secondary supply from two 1,000-gallon Underwriters' steam fire pumps. A large number of sprinklers opened and pumps were of value in supplying water under heavy pressure, although owing to the severe obstruction to distribution the work of sprinklers was unsatisfactory.

2813. Primary supply from city waterworks, 30 pounds pressure. Secondary supply, a 430-gallon steam fire pump. Fifty-seven sprinklers opened and pump was undoubtedly of service in keeping up pressure. Sprinklers held fire in check.

4156. Primary supply from waterworks, about twenty pounds pressure on sprinklers first opened. Secondary supply, two steam fire pumps of 1,000 and 500 gallons capacity draughting from private reservoir of 57,000 gallons and wells supplied by a six and four-inch connection from city mains. Five of the public department fire engines draughted from reservoir, which was soon exhausted. Fire pumps were then unable to obtain a full supply of water and were run at a reduced speed for a considerable time.

4275. Primary supply, gravity tanks giving nine pounds pressure on sprinklers before opening. Secondary supply from two 1,000-gallon Underwriters' steam pumps. Twelve sprinklers opened and pumps were started supplying water under good heavy pressure to sprinklers.

4885. Primary water supply from gravity tanks giving five to ten pounds pressure on sprinklers. Secondary supply from a steam pump. A large number of sprinklers opened, quickly exhausting water supplies.

7787. Primary water supply was from waterworks at 70 pounds pressure. Secondary supply from steam fire pump. Twenty-eight sprinklers opened and pump was used on sprinklers and outside hose protection for nearly two hours, holding fire in check.

9924. Primary supply was from gravity tank, 30 pounds pressure on sprinklers opened. Secondary supply, two 500-gallon steam fire pumps. Fifty-three sprinklers opened and were in service about half an hour, being supplied by water under heavy pressure from pumps. Fire held in check with small loss.

Unsatisfactory or Serious Fires in Risks Equipped with Sprinklers.

Where sprinklers fail the cause is, almost invariably, clear. These fires are selected to indicate such causes, that they may be generally understood and satisfactorily met.

8302. May 1, 1909. Oilcloth and Linoleum Factory. Fire occurred in drying building at 7.20 P. M., caused by stock falling on steam pipes or spontaneous combustion in newly coated linoleum. Building was of brick and timber construction, divided into two sections by a twelve-inch fire wall, and was equipped with Grinnell glass disk 286 degrees sprinklers on wet system. 1-2-4 pipe sizes supplied by a 1,000 gallon automatic steam pump, and secondary supplies of a 430 gallon steam pump and two gravity tanks. There was considerable linoleum stock in this section hanging in festoons from racks under gallery floor. This constituted a severe hazard as well as severely obstructing the water discharged from the sprinklers, and fire was finally controlled the following morning by the use of hose streams. Most of the stock either fell or was pulled down from the racks, forming piles on the floor which necessitated taking this out a piece at a time to extinguish the fire. Loss approximately $30,500. For further details see fire No. 8302, Oilcloth and Linoleum Works—Fire Record, page 486.

Summary: Severe hazard to distribution.

9366. November, 1909. Woolen Mill. Fire occurred in picker house, brick, mill construction, metal ceiled without concealed spaces, at 2 P. M., alarm given by employee. Starting in a rag picker in basement of picker house, fire was blown into gauze room in first story. On this floor there was a large quantity of loose cotton on floor preparatory to mixing. This ignited and spread fire into second story through belt holes and hole for elevator cable. From second story a flight of stairs ran to roof and fire communicated to roof and roof house over elevator. Fire was fought and extinguished by public fire department and private yard hose, sprinklers being of some assistance.

Building was equipped with Esty (spring) sprinklers on wet system supplied by gravity tank giving a pressure of twenty-five pounds on sprinklers first opened and a rotary fire pump. The secondary supply was of much service. Pipe sizes were small, being below the 1-3-6 standard; Parmalee system of piping, sprinklers spaced ten feet apart in ten-foot bays. Twenty-nine sprinklers in all opened. Three hose streams from pump and one from outside were immediately brought into action and confined fire loss mainly to stock in process, roof and roof house. Fire door between first

story of picker house and unsprinklered basement of main mill was of considerable service and prevented fire from entering building at this point. Fire entered card room of main mill through a large unprotected belt opening, but was held in check by a bucket brigade.

Fire proved too severe for the old and defective sprinkler equipment under light water pressure, which was further handicapped by the unprotected floor and belt openings rapidly spreading fire from floor to floor.

Summary: Old and defective equipment. Floor openings.

9280. November 26, 1909. Cotton Mill Warehouse. Construction; twelve-inch brick end and division walls, separating storehouse into four sections; each intended to contain about 1,000 bales of uncompressed cotton when piled six or seven bales high on side. Floors and roofs of plank and timber; each section had a line of wooden posts through center supporting roof.

Fire occurred in section No. 1 containing an opening room which reduced capacity of this section to about 750 bales. Cause of fire is unknown. Possibly a spark may have gone into building with cotton or spontaneous combustion started in the burlap covering or cotton.

All sections are sprinklered. Water shut off in winter, but is said to have been on the system at time of fire, and this is evident from the protection afforded to roof and wooden ends of building. Also, the wooden posts where they extended above the cotton pile were protected, but below these posts were badly burned.

The fire is supposed to have started low down in the pile near the middle of the section, but nearer the north wall. This section had a wooden joisted side on the north. These joists carried a wooden girder on which rested the roof timbers. The brick wall was built outside of these joists, and they were allowed to remain. But for the sprinkler protection above the cotton, these joists would undoubtedly have burned off entirely and allowed the roof to fall onto the cotton. The fire must have been burning for several days as one bay of flooring was burned out, allowing the cotton to fall through onto the ground below where several bales were consumed.

The surface of the pile of cotton bales, both top and ends, was wet by the water from 36 sprinklers opened and hose streams used, but the appearance of the bales after removal from the building seems to show that but little water reached the lower half of the piles until the upper bales were removed. There were large doors at both ends of the section which made it possible to remove the cotton from the building in about eleven hours. Loss $14,000.

Summary: Obstruction to distribution.

9926. December 1, 1909. Full Process Knitting Mill. The explosion of the 100 horse-power horizontal tubular boiler in the brick boiler house adjoining the two-story brick, mill-constructed picker house; also communicating with basement of main mill, wrecked the boiler house and sprinkler system.

Fire No. S-9926.

Showing the 100 horse-power horizontal tubular boiler which exploded.

Fire was caused by burning coal which was thrown about by the explosion. The explosion was evidently due to the incompetency of the engineer allowing low water in boiler some days before, probably weakening boiler plates.

Fire No. S-9926.

Showing boiler house wrecked by boiler explosion.

The boiler exploding wrecked the sprinkler systems in various sections of the buildings, causing more damage from water than fire. In fact the only fire was in basement of main mill directly in front of boiler house and started in some stocking boards near a wooden partition, opening three sprinkler heads which must have at least held it in check for a time, as damage is slight.

Buildings were equipped with sprinklers on wet system supplied by pressure tank and waterworks.

The boiler lifted by the explosion struck the main building at the third story, knocking in the brick work, leaving a hole about twelve feet in diameter at this point, then falling back into the yard. The boiler house was completely demolished, while the roof of the picker and dyehouse was

Fire No. S-9926.
Main mill building, showing effect of boiler explosion.

lifted bodily and thrown backward on the brick walls of the neighboring buildings. This had the effect of shearing off the four-inch risers which supplied the sprinklers in this building and put the system out of commission, and while the building was completely demolished the fire did very little damage and was confined to a few bales of cotton and shoddy and the timbers of the demolished picker room, although some machinery on the first floor of the dyehouse, which was apparently not hurt by the explosion, was badly damaged by water from the hose streams which were played on the ruins all night.

Flying debris shattered almost every pane of glass in the main buildings overlooking the boiler house, breaking a two and one half inch sprinkler pipe on the fourth floor of the new addition, besides taking off four heads on the drip pipe of the system in this building. In the main mill a sprinkler pipe was broken at a joint where a one and one quarter inch pipe fed five

sprinklers; two heads were also knocked off by the explosion. The fire alarm wires were broken so that the alarm had to be sent in by using a whistle on the gas house building nearby, but there was no need of an alarm, the fire department responding quickly. It is not known how long water was running from broken sprinkler piping, probably from one-half to three-quarters of an hour, when owner shut systems off.

Seventy-eight windows were broken in the piano factory located north of the boiler house, the debris doing considerable damage to the piano parts and cases being finished on the different floors. It is interesting to note, however, that while 65 panes of wired glass with which the windows directly exposed by the boiler house were protected, were cracked so that they will have to be replaced; all except those in the lower windows hit by the boiler house roof, remained firmly in the frames and would probably have checked the fire had they been called upon to do so. As it was, much valuable stock was saved by the wired glass, many more panes not being broken at all. The building located ten feet north of the dyehouse suffered the loss of ten windows of glass

Loss consisted mainly of water damage to finished stock on third and fourth floors of addition and to cotton and machinery on first and second floors; in the main mill water damage to machinery and unfinished stock; picker and dyehouse demolished and slight injuries to adjoining properties. Loss large.

Summary: Boiler explosion wrecked sprinkler system.

9409. December 15, 1909. Paper Stock Warehouse. Building of brick and joist construction used for the storage of loose and baled scrap paper. Fire occurred in the sorting department at night from unknown cause. Warehouse was equipped with Grinnell sprinklers, many of which opened. These were of no value, as system was shut off to prevent freezing. Fire controlled by city fire department, with a loss of about $700.

Summary: Water shut off to prevent freezing.

9531. January 25, 1910. Paper Mill. Building of stone and heavy joist construction; equipped with Grinnell glass disc sprinklers on wet system supplied by waterworks, ninety-five pounds pressure.

At about 3.30 P. M. experiments in charge of an outside firm were being conducted at the No. 1 paper machine in the first story. Between the last two pairs of dryers on the machine a metal pan running the width of the machine was inserted, through which the paper stock ran before passing out of the machines. This pan was filled with a solution said to consist of paraffin, "paraffin oil" and water, kept warm with a live steam pipe at the bottom of the pan. The solution smells of kerosene. Two small rolls above the tank, both heated with live steam, guide the paper stock into and out of the pan. A slight "pop" or "puff" was heard, and fire was seen at the pan spreading rapidly to the hood which was soon aflame. The draft of the fans which exhausted into the air at the second story wall, drew the flames up the ventilator boxing which passed through the second floor, and this quickly burned away, spreading the fire to the second story, and subsequently to the third story and roof.

A man was sent to ring the auxiliary fire alarm box in building No. 2, and others quickly brought two lines of hose in, one from the hydrant near the office, and one from the hydrant east of the machine shop. The public fire department, upon their arrival, laid six lines of hose from three steamers, perhaps ten to fifteen minutes elapsing before they were discharging water. Some uncertainty is shown as to the exact time of starting the fire pump, but from the action of the sprinklers in the second and third stories, and judging from their appearance after the fire, it is considered doubtful whether the pump was started until a few moments after the city steamers had so reduced the pressure in the mains that many heads in the second and third stories which opened were without water. At 4.55 the gauge at the pump showed one hundred and ten pounds, and the relief valve was blowing slightly. At this time both hose streams on the mill hydrants were shut down, while they were being relocated. Twenty-two sprinklers in the machine room opened, and confined the fire entirely inside the machine hood and ventilator in this story.

The sprinklers in the first, second and third stories are fed through a three-inch riser having a shut-off valve located in the machine room. This riser is fed in the first story by a four-inch pipe from the basement of building No. 2, which is in turn fed through four, five and six-inch pipe from the yard main. There were forty-two heads in the first story, forty-three in the second and forty in the third. There were no heads in the hood over the machine, and after the fire the three-quarters-inch pipe leading into the ventilator was found plugged, and no heads here. To this last may undoubtedly be laid the spread of the fire in the second story and above, as the ceiling over the burning machine was three-inch hard pine plank, and is only slightly damaged. Other than the two three-foot by four-foot ventilating openings in the floor enclosed by one thickness of seven-eighth-inch pine there was only one six-inch belt opening.

The second story contained large racks filled with wood cuts and electrotypes, many of them very expensive. These were used in printing advertising matter on the paper bags, sometimes in four or five colors. The type and wood cuts were largely oil soaked, and formed good fuel, and those not burned or charred are warped, cracked and out of shape, the result of being wet and drying.

The third story contained a paper cutter, tube slitter, several bag bottoming machines, etc., and some value in stock in process. The roof of section No. 1 is ruined, except that part over the office which was not damaged. The floor of the third story is one half to two thirds ruined, or badly charred. The machinery in the third story is mostly saved.

Thirty sprinklers in the second story, and forty in the third story opened, but probably received little water at first, and allowed the fire to gain such headway in these rooms that they were unable to control the fire, when the pressure was finally restored, by starting the pump. Fire burned into the basement slightly, but five heads opened here and extinguished it. At about 7.30 the sprinklers were shut off, it being apparent that they were of no further service. The fire was declared out at 8.30.

Had the full discharge capacity of either the pump or city water been concentrated on the sprinklers in building No. 1, and no hose streams used, the sprinklers in the first and second and possibly most of the third stories would have received ample water, and probably would have prevented the spread of the fire beyond the ventilating apparatus in the first and second stories.

Assuming that the sprinklers in the machine room were using 275 gallons of water, and no hose streams were running, there would be a drop of pressure in the line of about seven pounds, which would still leave an ample balance for the second story. As it was, the two mill streams and six city streams so reduced the pressure in the mains that it is doubtful whether for the first fifteen or twenty minutes before the pump was started the second story received any water. Loss $48,000.

Summary: Deficient water supply.

9474. January 30, 1910. Metal Worker. Fire occurred at 8 A. M., caused by the overflowing of oil feed to case-hardening furnace. Eleven sprinklers opened but were of no service, as valve controlling this section had been closed to prevent freezing. Loss $725.

Summary: Water shut off to prevent freezing.

9488. February 7, 1910. Woolen Mill. Fire started on the first floor of main building, occupied for finishing, storage, fire pump and office, at 2.45 A. M. while plant was not in operation. Alarm was given by outsider, there being no watchman. American ether spring thermostats connected to two dwellings, operated faintly in one house but failed in the other. Thermostat equipment old, and had given much trouble, being out of order at last inspection and test. Cause of fire unknown.

There was only a partial sprinkler equipment of Walworth pendant and ordinary heads in third story main building, boiler house and gauze room. Pipe sizes old standard, being 1-3-6. Spacing and arrangement of sprinklers, fair. Primary water supply was from a 1400-gallon gravity tank.

The fire apparently started near the fire pump or in dyer's office, and when discovered had only spread over a small area. Outside protection was from a volunteer fire department. Probably twenty or thirty minutes elapsed after alarm before apparatus arrived, as fire station is one mile distant and without men or horses. By this time gravity tank was empty. The fire, starting in the unequipped portion and near fire pump, was soon beyond control, although sprinklers in third story are said to have operated and checked fire as long as there was water in the tank. The only hydrant available was on a six-inch dead end main and furnished but one efficient stream. Steamer was placed to pump from river nearby, but as soon as it took water suction, froze and was not used again, temperature being fifteen degrees below zero. Building and contents was practically a total loss.

Summary: Defective and partial equipment. Fire started in unequipped portion.

9495. February 10, 1910. Broom Factory. Fire occurred in second story at 11 A. M., caused by a match on floor. Room was occupied for storage of finished brooms, broom corn, and supplies. Building was constructed of concrete block walls, joisted floors and roof. All sprinklers in this section opened, but were of no service as system had been shut off on account of the defective dry system leaking air badly. Loss $2,100.

Summary: Water shut off on account of defective dry system.

9499. February 12, 1910. Clothing Factory. Fire occurred at 6.30 A. M. in the fire-resistive tenant manufacturing building on the eighth or top floor, occupied for manufacturing ladies' waists. Cause was evidently from spontaneous combustion of rubbish and waste cuttings under cutting table. Fire was discovered by the city fire marshall who was passing. There was no watchman. The Universal lever electric sprinkler alarm connected to inside and outside bells failed to operate. Building was of good, fire-resistive construction, which was of much value and confined fire to the floor on which it occurred. For detailed report of construction see fire No. 9499 of the Fire-Proof Building Fire Record, page 506.

Floor on which fire occurred was equipped with Esty No. 6 sprinklers, eight by ten feet spacing on smooth ceiling, not staggered; 1-2-3 pipe sizes, side central feed; wet system, supplied by a 12,000 gallon gravity tank, only supply, giving twelve to thirteen pounds pressure on sprinklers opened. Eighty-five of the 86 sprinklers opened and held fire in check until gravity tank was exhausted, fire being discovered about this time and extinguished with a chemical stream by fire department. Sprinklers could not reach seat of fire on account of the severe obstruction to distribution from a large cutting table.

The top floor was divided into three sections by wooden partitions six to seven feet high, extending from floor to within four or five feet of ceiling. The east section, in which fire started, was nearly seventeen feet wide and used as a cutting room, containing three large cutting tables, three feet two inches wide and 70 to 75 feet long, with a two-foot space between tables and partitions. Tables were two feet seven inches high, with a one-and one-fourth inch top; sides flashed down from the top with a six-inch board and a similar baseboard twelve inches high at sides at floor. Waste cuttings were thrown under table into this pocket or bin. There were two heavy glass skylights over this room and two over sewing room adjoining.

Fire started in the end aisle or under the end table. Sprinklers immediately opened and confined fire under this table until so many sprinklers were opened by the heat that little or no water was being discharged from the end sprinklers which allowed fire to spread out on the further side igniting patterns and shelving on brick wall. The sprinkler lines ran at right angles to the cutting tables with seven or eight heads to a line, the last head being directly over the end table.

The heat must have been intense, and there is no doubt of a large number of sprinklers discharging water while fire was in progress. This is substantiated by the fact that the ceiling over 47 sprinklers had been wet for

an area of a foot or more, eleven had wet ceiling over an area of three inches, eight had wet ceiling which had later been blackened by smoke and fire, and sixteen gave no evidence of having discharged water. It is not known whether sprinklers under skylights discharged water or not.

The fire damage to the building was slight, owing to the excellent construction. Table was charred considerably on the under side and boards at sides were burned through. Flooring also was burned through at one place. The water damage, however, was heavy, extending down to the fourth floor. Practically all the water in gravity tank was discharged through the sprinklers. Fire must have been burning for a considerable time before being discovered. Loss large.

Baseboards should be removed from around tables so that floor may be cleaned of all cuttings and waste material each night and removed to waste vault.

The Association's fire record of clothing factories shows that approximately twenty-two per cent of fires occurring in this property are from waste material.

Watchman service with approved watch clock should be employed. Had this been the case, fire would probably have been discovered in its incipiency and the large loss prevented.

Summary: Obstruction to distribution.

9593. March 6, 1910. Carriage Factory. Buildings were mainly of large area, frame construction, one high story and occupied for woodworking, painting, blacksmithing, storage, etc. Interior protection consisted of a fair supply of pails of water and sand, watchman reporting on approved portable watch and an old standard sprinkler equipment, very well installed according to rules in force at that time. Only one water supply from city mains, which is very deficient in volume, but of fair pressure. Pressure is not raised on alarm of fire. About ten heads can be supplied at fair pressure and volume, which number is insufficient to control a fire of any size, considering the class and construction of risk.

The system covered the greater portion of the property, but unsprinklered parts adjoined and seriously exposed sprinklered portions because of the construction. The obstruction to sprinkler distribution from stock on racks in wood shop and storage building was moderate. The dry valve was heavily overloaded, supplying a total of 678 heads; there were 302 heads in one fire division.

The outside protection consisted of three private hydrants, provided with hose houses, hose and equipment; also volunteer fire department and assistance in the way of hose and equipment from adjacent mills.

Cause of fire is unknown, the only theory advanced being spontaneous combustion of rubbing-rags or waste used in upholstering and painting department, watchman being the only one at plant after closing the day before. Watchman discovered fire after his 11.30 P. M. round.

On discovery of the fire the watchman gave the alarm to the central telephone station, from whence the special fire alarm was given; it is esti-

mated that about twenty to thirty minutes elapsed between discovery of the fire and arrival of the fire department, which is volunteer, with one-horse hose wagon, located about one mile distant over level sandy road.

Soon after discovery of the fire it is stated that the floor of the building caved in, breaking a five-inch sprinkler main supplying sprinklers in west storage building, which put the sprinklers out of commission and reduced the ordinarily deficient city supply to such an extent that it was practically of no value. The sprinklers were shut off, and efforts were made to protect the surrounding property. All hydrants were located on the north and east sides of the plant, and as the wind was blowing in this direction, the hydrants had to be abandoned and fire fought with hydrants of adjacent property. The main building was protected by a bucket brigade on roof and at windows.

The waterworks supply to sprinklers was very deficient, and could not be counted upon to control a fire opening more than ten heads. The outside protection was also deficient, only one efficient stream being available. Fire spread rapidly on account of construction and occupancy of the building, and protection was of little value. Loss approximately $50,000. Owners a short while before fire refused to comply with the suggestions to install fire pump and reservoir or large gravity tank to bring their protection up to an efficient standard.

Summary: Deficient water supply.

9486. March 10, 1910. Manufacturing Storage Batteries. The fire was discovered and the alarm turned in by the watchman at 1.40 A. M. The private brigade responded at once, and had three streams playing on the fire in less than four minutes.

The sprinkler system was shut off at time of fire for the following reason: The frame one-story building situated about ten feet south of storage battery plant, formerly used as rolling mill, is now occupied by a chemical manufacturing company. The latter company built an additional story on west end of their building, and in order to supply sprinklers in latter, it was necessary to increase the size of main sprinkler riser, both buildings being on the same sprinkler main. The water was shut off from sprinklers in these buildings the day before fire to make this change.

The fuse in circuit with electric system is claimed to have blown after fire was well underway and while firemen were at work, which, if true, might indicate that defective wiring was not the cause of fire, for short circuit of wires would probably have blown fuse at once.

While the whole storage battery department was practically razed, the firemen did very good work to confine the fire to the one building, preventing fire from spreading to chemical works and main machine shop.

Practically all sprinklers fused and opened.

There will be a very little salvage in a supply room on the first floor, but loss to this building and contents is practically total. Loss approximately $18,000.

Summary: Water shut off on account of repairs.

Fire-Proof Building Fire Record.

These fires are selected to illustrate the behavior of various forms of fire-resistive construction under exposure to fire from within or without.

S-9315. December 14, 1909. Printer and Bindery. Building of fire-resistive construction, steel frame, brick walls; floors of eight-inch cinder concrete flat slabs, five feet spans between steel I-beams, smooth cement top finish. Floors were carried on twenty-inch double girders; floor beams and girders protected by from two to two and one-half inch cinder concrete over wire mesh with hard cement finish. There was no wood used in construction and floors were not self-draining or waterproofed other than smooth cement top. This surfacing of floors was lined off into squares of approximately three and one-half feet.

The entire building vibrates and sways one-sixteenth of an inch when presses are running, according to the engineer's statement who recently made some experiments, and this vibration ruptured the cement finish of the floors, the cracks mostly following along the lines mentioned above.

The fire occurred on the tenth floor at about 7.03 A. M. The cylinder presses on this floor are cleaned at night with benzine and the rags are thrown into an ordinary rubbish can. On the night of fire this can was not emptied but left near elevator close to pile of waste paper. The rags, which probably contained a considerable quantity of printer's ink and oil, apparently ignited spontaneously. Can was not covered and fire spread into a pile of paper when one sprinkler opened and practically extinguished the fire.

Electric light wires for house current are run in conduit enclosed in sheet iron, wire-run approximately three and one-half feet wide and fourteen inches deep with communications from first to fourteenth floors with panel boards on each floor. This wire-run was on end of building near where fire started and damage from water was mostly to panel boards on sixth, seventh, eighth, ninth and tenth floors, also a considerable amount went through the floors, the greater portion of which was due to the cracks in the cement surfacing of the floors. On the ninth floor several small motors, installed on different machines, were damaged by water. Loss on building $100.

This fire shows the necessity of properly draining all floors in fire-resistive buildings, making same as nearly waterproof as possible.

H-4545. January 14, 1910. Rubber Reclaiming and Manufacturing. The fire started in the main room on the upper floor of Mill "B" and was first seen in the drying screens where the reclaimed rubber ground to a fine pulp, was spread and subjected to a draft of air heated by being forced through steam pipe coils by fans. The fire was probably caused by an

overheated journal in this rapidly revolving fan system. The watchman's clock showed that he had visited this room within twenty minutes prior to the discovery of the blaze by the mill employees who were working on the ground floor of the building. The private fire department was at once called into action and in a short time five streams of water were in service.

The building was constructed of reinforced concrete with eight-inch walls, and sixteen-inch piers, four-inch floor on heavy concrete columns and stringers. The roof was composition laid on several thicknesses of boards, trusses braced with iron rods. The only ignitable materials were the stock, the roof, one frame partition and the wooden framework of the drying apparatus. The stock was particularly inflammable and evidently burned fiercely, for, despite the water thrown upon it, the heat was suffi-

Fire No. H-4545.

Roof was supported by wooden trusses braced with rods. These expanded during fire, allowing roof to collapse, tearing down the reinforced concrete walls into which they were fastened.

cient to cause the iron roof rods to bend under the weight above them and tear down the concrete walls into which they were fastened, thus demolishing all of Mill "B" above the floor line of the second floor.

The damage to the property on the lower floor was almost entirely by water, though some little fire dropped down from above.

Separating Mills "B" and "C" was a reinforced concrete wall which did not go through the roof. Through this wall was a large opening on each floor protected by a single fire door on the Mill "B" side; that on the second story was torn away in some manner, probably by the falling roof, and the fire spread into Mill "C," although the damage by it was confined principally to the crude rubber which was hanging up for air drying. There was considerable water on the ground floor of Mill "C."

S-9499. February 12, 1910. Clothing Factory. Building is eight stories in height, of fire-resistive construction, with brick bearing walls, steel interior skeleton; floors, eight-inch terra cotta segmental arch construction sprung between I-beams and covered with two inches of cinder concrete in which the floor sleepers were embedded and to which the seven-eighths inch maple flooring was nailed. Columns are round cast iron protected by two inches of terra cotta. The floors are not water tight or arranged to drain. The ceiling of top floor where fire occurred is of flat arch construction. Building was equipped with a modern sprinkler system.

Fire was caused by spontaneous combustion of waste clippings and rubbish under a long cutting table on the top floor where water from sprinklers could not reach it. This caused 85 of the 86 sprinklers in room to open, so depleting water supply to sprinklers that many heads were without water.

The excellent construction of the building, however, confined fire entirely to this floor, although the heat must have been intense as sprinklers were opened a considerable distance from fire. There was practically no damage to building, with the exception of one place in flooring under table which was burned through.

The water loss, however, was heavy and extended down to the fourth floor. If floors had been arranged to drain and waterproofed, loss would have been slight.

The work of the sprinklers was unsatisfactory on account of the severe obstruction from the cutting table. For details see Unsatisfactory Sprinkler Fire No. 9499, page 501.

H-4037. February 21, 1910. Trust Company and Office Building. Building was erected thirteen years ago, height twelve stories and attic, area 110 feet by 160 feet. Steel skeleton construction, exterior columns protected with nine inches of brick; curtain walls of brick thirteen inches thick, supported upon twelve-inch steel beams. Interior columns built up of Z bars encased in three-inch porous hollow tile and cement mortar, surfaced with plaster. Floor construction: flat arches, constructed of semi-porous tile eight inches in thickness, side construction, spaced six feet seven inches by fifteen feet three inches. Flooring was one and one-eighth inch maple on cinder fill. Roof was covered with felt, tar and gravel. Interior partitions were three-inch hollow tile finished with plaster, hardwood and paint. There was one elevator and stairway from basement to twelfth floor, with unprotected openings in all floors. There was also no window protection.

Fire occurred on the twelfth floor from unknown cause and spread to attic through an enclosed light shaft with metal skylight on roof. This part of the floor formed one large room of an area of about 43 by 158 feet. This was used for office purposes, the north end where the fire originated containing wood shelving for storage of records, and the contents within this area were destroyed.

Fire was fought and extinguished by public fire department with hose

Fire No. H-4723.

Photo No. 1. Showing highly ornamental tile fronts. Window frames burned out on ninth and part of upper floors.

Fire No. H-4723.

Photo No. 2. Typical dining room, showing paneled oak walls.
The photograph shows dining room on eighth floor undamaged except by water from upper floors.

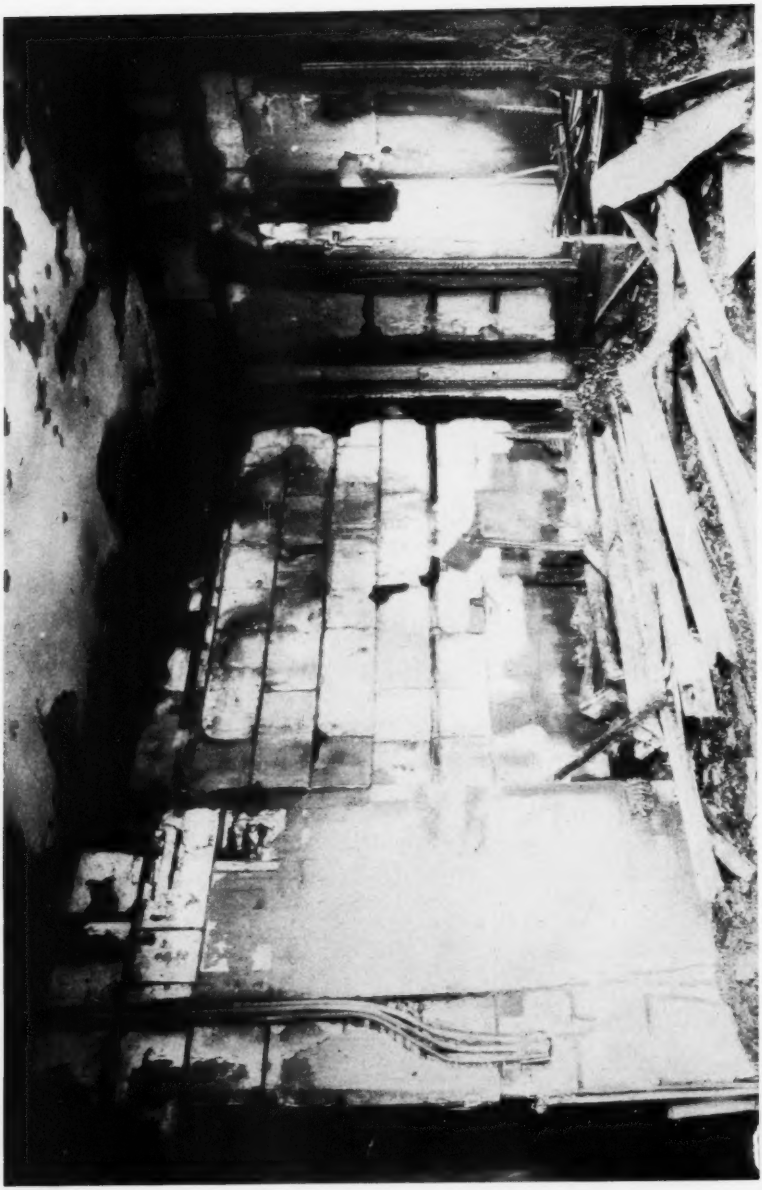
streams from inside standpipe supplied by a siamese connection from city steamer and two lines of hose taken from steamer to twelfth floor on outside of building. Fire was soon under control, with slight damage.

There was no injury to the structural steel columns or the interior steel columns or beams. The interior fireproofing on floor columns and lower flanges of steel floor beams was partly checked and broken. The lower face of tile forming six spans between columns was in a checked and broken condition. The brick arches over window openings were partly damaged. The terra cotta cornice was slightly damaged above window openings. The single and double wood mullions, windows in north, east and west walls of the twelfth floor and attic were destroyed. One-half of the skylight on the roof was destroyed.

H-4723. March 4, 1910. Apartment House. Construction.—Twelve-story basement and sub-basement fireproof building of skeleton steel construction. Erected 1909. Area 100 by 115 feet. Flat 4-inch cinder concrete floor arches with a rough floor of ¾-inch boards on wood sleepers, filled in between with cinder concrete and ¾-inch finished parquet floor of oak on top; 12-inch, 31½-pound I-beams, a few beams 10 inches, 25 pounds; 5 feet to 6 feet 11 inches on centers; 12-inch, 15-inch and 18-inch— 40, 42 and 55 pound I-girders; most floors above first have twin 12-inch, 40-pound I-beams for principal girders. Built up steel columns using two channels and two plates, some latticed columns used on ninth floor and above; exterior columns protected by 4-inch brick, others by 2-inch composition plaster blocks with air space between blocks and columns. Girders protected by arches and 3 inches to 4 inches of cinder concrete on web, and wire lath and plaster on lower flanges; beams by arches on web and wire lath and plaster on flanges. Foundation base of columns rests on cement on rock. Curtain walls carried on steel frame and range from 20 inches on first floor to 12 inches at top; walls of brick, faced with highly ornamental terra cotta north and west, brick south and east. Partitions of 3-inch plaster blocks set in wood framework. Roof of similar construction to floors; roof structure about three-fourths the area of building; sides built of terra cotta blocks set in steel framework and covered with corrugated iron on the outside. Stairs of iron with steel web plates under marble treads and landings; enclosed in 4-inch terra cotta shaft, unprotected openings to hallways. The latter formed by partitions of 3-inch composition blocks with kalamein doors to apartments. Three elevators separately enclosed in shafts built of 4-inch terra cotta blocks set in angle iron framework, with kalamein doors at openings to hallways; the doors to elevators and in hallways have mirrors set in the panels over the metal. The west apartments at ninth and tenth floors, in which the fire started, are connected by two open stairways and an open wellhole, forming a duplex apartment. Walls in dining rooms finished in paneled oak; walls of reception halls largely wood with Circassian walnut stain. (See illustrations Nos. 2, 3 and 4.) Sides and ceilings elsewhere mostly plastered, part direct and part on wooden furring; the trim is of wood, painted white.

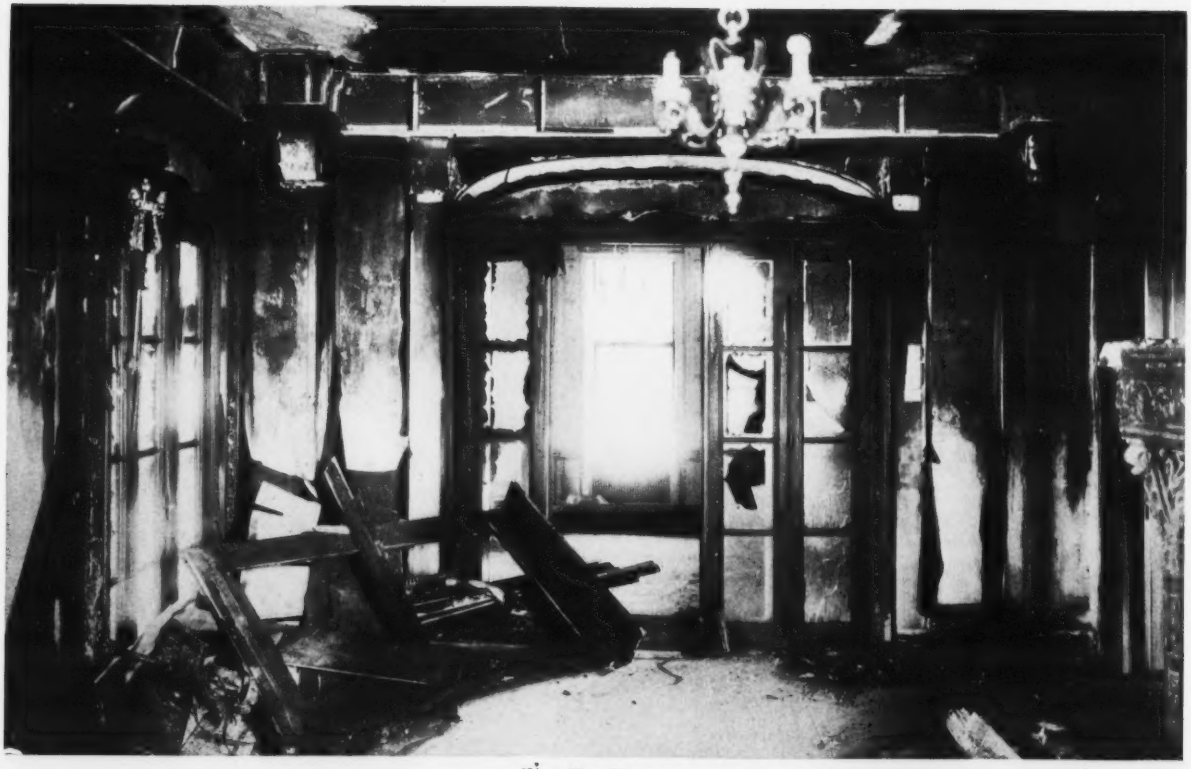
Occupancy.—Sub-basement was occupied for boiler room, coal and

The photograph shows dining room on eighth floor undamaged except by water from upper floors.



Fire No. H-4723.

Photo No. 3. Similar view of Photo No. 2. Showing typical damage by fire to dining rooms above eighth floor.



Fire No. H-4723.

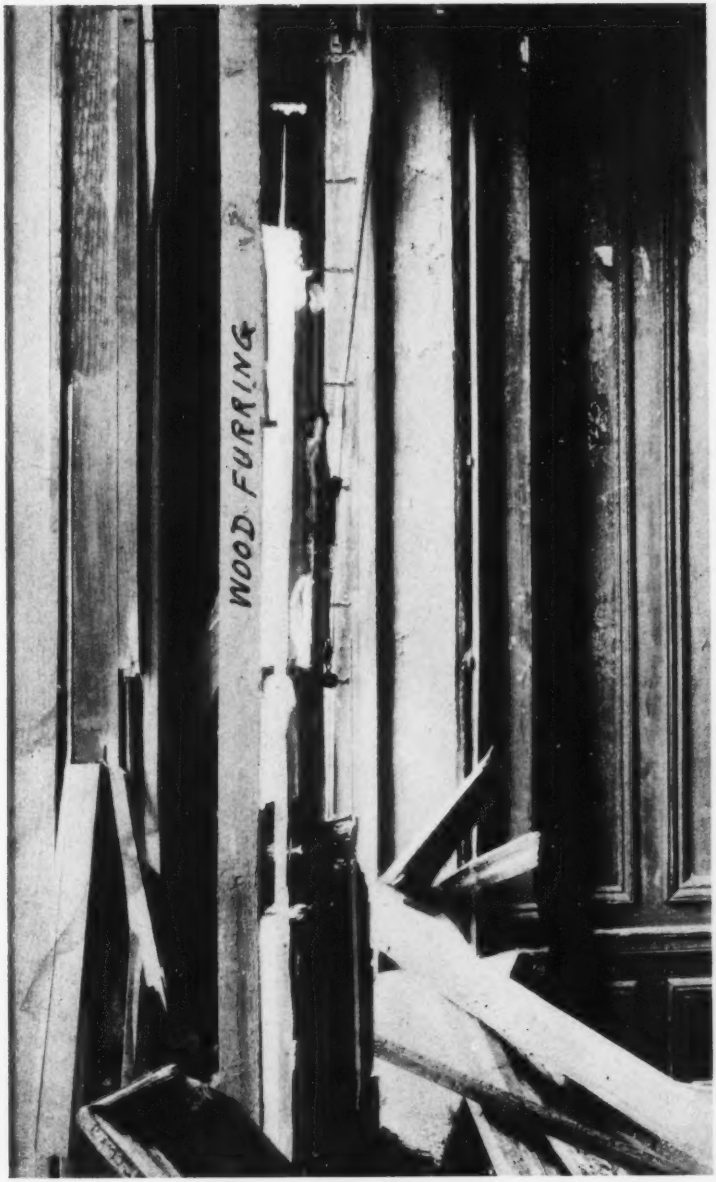
Photo No. 4. View of typical reception hall showing partially burned wood trim with Circassian walnut finish, which was used extensively on side walls in these halls.

general storage. Basement, laundry and dry rooms, servants' and janitors' quarters. First to 12th floors, two apartments to a floor, fourteen rooms and five baths each. The 9th and 10th floors at west side constitute a duplex apartment and are connected by two open stairways and an open wellhole. Maids' quarters in roof structure.

Cause of fire.—Spontaneous combustion of waste material used by painters is generally accepted as the cause.

Progress of fire.—The fire started on the 9th floor at the west side, in the lower story of the duplex apartment, which was being rearranged and specially finished by the occupant. Many of the rooms contained an unusual amount of lumber in the form of wood trim, parquet flooring, side and ceiling paneling and other decorative woodwork. The painters' supplies were on the 9th floor. There was no furniture in this apartment; the 11th floor apartment was also empty. The fire spread directly through open stairways and wellhole to 10th floor, and was burning throughout the 9th and most of the 10th floors in the duplex apartment when discovered. It was first noticed when the flames burst through the windows, perhaps twenty minutes after the fire started. It spread rapidly from the 10th to 11th floors, and in turn to 12th floor through the exterior windows, particularly in the dining rooms at angle of south wall. These rooms were completely gutted by the fire, due chiefly to the fuel afforded by oak-paneled walls. (See illustrations Nos. 2 and 3.) The tin-clad fire doors at hallways prevented the fire from spreading horizontally. The fire was fought by using the inside standpipes, and by carrying leads of hose up through building. The water tower streams are said to have reached as high as the top floor, but could not be directed into the windows at that height.

Damage to structure.—The 9th and 10th floors in the duplex apartment were gutted except the northerly rooms of the 10th, which are badly damaged. The dining room and reception hall of west apartment on 11th floor were practically gutted, with heavy damage in kitchen and moderate damage in other rooms. In the west apartment on the 12th floor, the dining room, reception hall and living room, including salon, were practically gutted; considerable damage in kitchen and maids' room; only moderate damage in northerly rooms. The west apartments immediately below the floor where the fire started had considerable water on ceilings, walls and floors; part of ceiling plaster has fallen in a few rooms. There was no fire and but little water damage in easterly apartments, including those above the 8th. There seems to be no structural damage to the steel frame or its fireproofing; the lower flanges of the floor beams were protected only by plaster finish, which fell off and exposed the flanges to considerable heat, but no deflection of beams is apparent. The channel shaped steel lintels over dining room windows were softened by the heat and deflected, particularly those on the 12th floor. The three-inch plaster block partitions are intact except around doorways, where they were supported by wooden framework, which was entirely burned away and caused the blocks to fall. The ornamental glazed tile at west front sustained slight damage to cornice at 10th. A small portion of the hollow metal roof cornice was broken away to ascertain if there was any fire back of it.



Fire No. H-4723.

Photo No. 5. Wall finish with hollow space and wood furring.
Finish shown in photograph not damaged by fire but demolished to determine if any fire was smouldering in concealed space.

Fire No. H-4723.

Photo No. 6. Wall finish on wood furring similar to Photo No. 5. Photograph does not show full extent of damage, fire worked into hollow space.

Recommendations.—A concerted effort should be made to minimize the amount of wood used in wall finish and for other extensive decorations, particularly in the upper floors of fireproof buildings, where public fire protection is not readily available.

While hard wood is now popular for interior decorations, there are other materials which make acceptable substitutes and their use should be encouraged by architects and builders. (See illustrations Nos. 2 and 3.)

Ordinary glass windows greatly facilitate the vertical spread of fire exteriorly from floor to floor, particularly in the upper stories of fireproof buildings, where the fire department streams cannot readily reach the windows. This fact reduces the efficiency of fire stops for floor openings, and deserves careful consideration from the standpoint of safeguarding life and property in high buildings used for residence or other purposes.

The exterior windows in conjunction with the fuel afforded by the oak paneled side walls in dining rooms caused the fire to spread rapidly from floor to floor until it reached the roof.

Outside fire escapes with landings at each floor should be required by law on all fireproof buildings and be located adjacent to inside or outside standpipes having hose connections convenient to be handled from the landings.

New York, with its abnormally high fireproof buildings and congested values, is seriously deficient with regard to this type of fire protection, in comparison with other cities. These exterior fire escapes are often important in saving lives, and are essential to the fire department if water from the separate fire main system or steamers is to be applied effectively and promptly in the upper stories. Valuable time was lost in this fire owing to the lack of outside fire escapes.

Considerable wood furring was used to carry portions of the wall finish. Wood furring is always objectionable, but particularly so in fireproof buildings, and its use should be avoided.

In this fire the hollow space and wood furring helped to carry the fire, and where it had not been burned the firemen chopped it down, to be sure there was no fire left in the concealed space. (See illustrations Nos. 5 and 6.)

Fire Causes.

The fires here given are selected to illustrate defects, either of construction or superintendence in the classes of property indicated.

H-4461. Agricultural Implements. The wooden floor over boilers in power-house ignited from the overheated pipe leading from boiler to smoke stack. **All woodwork around or near flues or over boilers should be covered with asbestos and sheet metal.**

H-4555. Moving Picture Theatre. The fire was caused by machine operator removing a piece of hot carbon from the holder and dropping same into a receptacle for hot carbons. A spark caused by dropping the hot carbon ignited a case of films which were nearby in a sheet-iron box, but with the **cover open.**

The fire caused a panic among the 500 people present, although none were seriously injured.

Covers on metal boxes containing films to be kept closed at all times.

H-4565. Garage. As a car was about to leave, a boy struck a match to look under same. This ignited some gasolene spilled on grease apron under car. Car could not be removed and fire spread over car and others nearby. The heat, flashes of fire and fear of explosion prevented firemen from entering building. About 26 cars were destroyed or badly damaged. Loss large.

H-4575. Wire Nail Works. Watchman accidently set fire to some waste while using a light—was filling his lantern with oil at the time. Loss approximately $20,000.

Watchman's lanterns should be filled and cleaned during the day.

H-4583. Department Store. "Pinter" gasolene lamps were used for lighting store. The generation of gasolene gas is started by the use of a small wood alcohol torch suspended under the burner to heat gas generator. In some way this became detached, falling to floor and igniting gasolene flowing from lamp through open valve or leak. Gasolene also ran onto a rack of ladies' cloaks and bargain tables directly underneath.

The use of gasolene gas lighting systems is hazardous, especially where individual generators are used. Lamps should not be located over tables, counters or near combustible material, but over vacant floor space where there will be less liability of a serious fire should the alcohol torch or gasolene drop to the floor.

H-4622. Manufacturing Florists' Wire Frames. Employee was dipping wire frames in asphaltum thinned with benzine. It is supposed that the vapors ignited from open gas lights nearby.

Open lights should not be used in rooms where asphaltum dipping is carried on. If artificial light is necessary, vapor-proof, keyless socket, electric lights should be installed, the switch being located outside of dipping room.

H-4674. Metal Worker. Fire occurred at 11 P. M. Plant was not in operation. Watchman was varnishing shovels at a varnish dipping tank, using an ordinary kerosene oil lantern for light. Lantern ignited vapors from tank, causing an explosion and igniting varnish. Loss $40,000.

Open lights should not be used where paint or varnish dipping is carried on.

H-4695. Mercantile. Fire started at the bottom of a show window which was decorated with cotton batting. The window was lighted by Tungsten lamps at the top. It is possible that cotton came in contact with these lamps and dropped to bottom of window, as a passing fireman saw a blaze start at the bottom where there was no wiring. Loss approximately $30,000.

The use of cotton batting or other inflammable material should be discouraged for decorative purposes.

H-4706. Glass Factory. Attendant was putting coal into gas producer. A large piece of coal caught in the door and prevented door from being shut. A back-draft occurred, forcing gas out, which ignited and practically destroyed building. Loss $35,000.

Gas producers shall be located in a fire-resistive building, and care exercised in attending apparatus.

S-9110. Woodworker. Sparks from an emery wheel set fire to contents of a paint dip tank nearby.

Emery polishing and grinding wheels should never be located in the same room with dip tanks.

S-9163. Chocolate and Cocoa Manufacturing. The machine which caused this fire and in which it occurred was a quadruple chocolate mill of a daily capacity of five tons of chocolate. The cracked cocoa is fed to the machine through automatic hoppers located in floor above, passing into the machine between the grinding surfaces of revolving stone mills.

These stones are imported with the machine and are known as "Buhr" stones. Considerable heat is generated by the grinding process which is normally absorbed by the ground cocoa (chocolate liquor). At the time of fire the cracked cocoa feed became clogged, and as no stock was fed to the machine, the friction of the grinding stones generated sufficient heat to ignite the chocolate liquor, part of which remained sticking to the under millstone. Fire was easily extinguished by chemical extinguishers, but considerable of the ground chocolate liquor was ruined by the chemical stream.

S-9190. Woodworker. Plumber used a candle in looking for break in blower tube from buffing wheels, igniting dust and lint.

S-9201. Mercantile Building. Fire was caused by workmen using open candles for light in trench which had been made along wall for carrying off water which seeped through wall and flooded basement floor. Walls of trench were being coated with asphaltum paint in which benzine was used as thinner; basement was dark and candles were used by workmen, who were examining trench to see if work was properly done; fumes of paint were ignited; there was a sudden flash and immediately the entire trench was aflame. Five sprinklers were opened by the quick flash fire.

S-9228. Automobile Factory. Fire occurred in the one-story brick constructed room used for impregnating magneto coils, also varnish dipping. Employee washed floor with gasolene to remove varnish, and then started testing magnetos before vapors had cleared from room. A flash fire occurred, igniting a pan of gasolene and varnish on floor.

Gross carelessness.

S-9284. Department Store. Fire occurred in the room occupied for garment repairing, being caused by employee laying a garment over a lighted electric light bulb. **Electric lamps on extension cords should be protected with a wire guard so that same cannot come in contact with inflammable material.**

S-9318. Bakery. Fires have been known to occur on steam engines around the steam cylinder where cylinder was wood lagged. In this case oil from valve gears had leaked into space between steel lagging and cylinder, which was packed with asbestos from one inch to five inches thick. Engineer had smelled overheated oil for some time previous and examined various bearings but could not find the trouble. In about half an hour he saw smoke coming from cracks around cylinder. On taking off the steel lagging he found fire in the asbestos and parts of it red hot. Had this cylinder been wood lagged it undoubtedly would have taken fire

S-9345. Picture and Moulding Factory. Fire started in spraying room, caused by an electric spark from a key socket, attached to an incandescent light located inside a metal spraying booth, igniting a small quantity of benzine in open bucket standing on floor in front of booth, about five feet distant from socket. At time of fire a large electric motor-driven blower fan was in operation, drawing fumes from spraying booths through a large metal pipe attached to same and extending up through second floor to outside of building through brick wall. The flames were drawn through this pipe, over-heating it; flames also gained access to second floor through small unprotected floor opening around this pipe, thus causing the opening of sprinklers on second floor. Fire extinguished by automatic sprinklers.

This is an extremely hazardous process. Room should be equipped with vapor-proof electric lamps, switch to be located outside of room. Benzine should not be used from open buckets or pails.

S-9360. **Drug House.** Employee opened a can of carbon bisulphide near a lighted gas stove. Vapors ignited, opening one sprinkler.

Carbon bisulphide is more dangerous than gasolene and in the same class with ether and benzol; the explosibility of these liquids ranging ether, benzol, carbon bisulphide. Carbon bisulphide vaporizes rapidly at ordinary temperatures and is highly inflammable at 114 to 116 degrees F. The vapor is approximately two and one-half times heavier than air. The flash and burning points are nearly the same, being about 300 degrees F. A mixture of six per cent of vapor in air has a highly explosive tendency, the heaviest explosions occurring from a mixture of one part air to fifteen parts vapor. A lighter mixture will carry fire through the medium of its vapors for some distance to container. The vapors are most easily ignited from a spark or open light and the liquid will take fire of its own accord if subjected to heat. Steam pipes under a temperature of 300 degrees F. will cause an explosion of the vapors.

Carbon bisulphide should not be used or exposed where there is danger of sparks or open lights.

S-9502. **Metal Worker.** Fire was caused by the spontaneous ignition of oily rags in an open top metal waste can.

Approved metal waste cans only should be used. These are provided with a cover riveted to can, with a lid permanently and freely hinged and weighted to close automatically so that same cannot be left open.

Points of Interest from Fire Reports.

These notes are intended to illustrate the efficiency or inefficiency of signalling, retardant or extinguishing agencies.

Alarm Service.

H-4462. Watchman discovered smoke coming from the hollow ceiling of ninth floor and blew his whistle. His signal called the night fire brigade and the fire marshal, who sent in alarm on the central station system, calling public department.

H-4566. Auxiliary alarm box was located in a shop on first floor about ten feet away from entrance doors. Tenants were instructed to break glass in doors, and send in alarm should fire occur in the building. This was evidently forgotten, and nearly ten minutes' delay was caused by sending in alarm through another box.

If auxiliary alarm box had been located on outside of building or in hallway, first floor, this delay might have been avoided.

H-4609. Watchman was asleep when fire started, and fire was discovered by watchman at neighboring plant about six hundred feet distant.

An approved watch clock system would check watchmen.

S-9003. There was no Sunday watchman, nor alarm valve on sprinkler system. Fire occurred at 3 P. M. on Sunday, opening five sprinklers which were in operation until smoke was seen by outsiders. This caused an excessive water damage.

Watchman service should be maintained nights, Sundays and holidays and at all times when plant is not in operation. An approved central station system or an approved clock system should be used, by means of which the watchman shall record rounds whenever plant is not in operation. This will insure watchman's visiting all portions of the property.

S-9156. Fire occurred from unknown cause in a barrel containing small wooden parts. One sprinkler directly over same opened and extinguished fire. Watchman heard sprinkler alarm and immediately located fire and closed gate valve. Water discharged from sprinkler was drained off without going through to floor below where a large stock of finished pianos was stored.

S-9160. Fire occurred in boiler room at about 2 A. M. One sprinkler opened and extinguished the fire. Watchman heard water running in sprinkler pipes but failed to locate the open head. Engineer coming to work in the morning discovered water discharging from window into alley. Sprinkler was located near window and loss was slight.

S-9319. Outsider heard rotary sprinkler alarm and notified watchman, he failing to discover fire. Watchman made hourly rounds, registering on stationary clock.

S-9346. Fire probably orginated at heating furnace in adjoining unsprinklered building near front end of store; both buildings have window bulkheads to street in basement; a small wire-hole about two inches in diameter through fire wall near top of bulkhead allowed heat to pass into this building and open a sprinkler head about eighteen inches from opening; which prevented fire from entering building. Sprinkler alarm operated and signal was immediately transmitted to alarm service headquarters, which in turn sent out insurance patrol; insurance patrol pulled city box on arrival at premises.

Automatic Sprinklers.

S-9135. Room was one story in height, of frame and glass construction, and used for nickel-plating. Fire was extinguished with chemical extinguisher, no sprinklers opening owing to their being badly whitewashed.

When whitewashing or painting rooms in which sprinklers are installed, particular care should be taken not to coat sprinkler heads, as this protects the solder, raising the fusing point of same and retarding the operation of the sprinkler. This should be particularly looked after in the use of a painting or spraying machine.

S-9174. Several freight cars were burning on track near works. In moving these a switch engine shunted a burning car on track near building. Thirteen sprinklers opened and prevented fire from entering building.

S-9234. Fire started in a fireproof boiler room from defective electric wiring, igniting insulation and setting fire to belts of engine. One sprinkler opened over the rubber belt coal conveyor and stopped the spread of fire in that direction.

S-9368. Fire occurred in ginnery, due to matches in seed cotton. Sprinklers held fire in check as soon as it burned through top of condensor head, twelve sprinklers opening. Condensor was not equipped with sprinklers and fire spread into lint press. Press was run down onto the burning cotton and sprinklers extinguished fire in all places where distribution was not obstructed.

S-9508. Sprinkler system was entirely out of service, as tank (only supply) had been removed a day or two previous to that on which the fire occurred, in order to install a new tank. In spite of the fact that there was no pressure on the heads and the heads were old, more than 90 per cent of them opened in area affected by fire. Good cutoffs and the fact that fire occurred on top floor limited damage to building. Loss large.

When necessary to shut off sprinkler system for repairs, casks of water and pails or chemical extinguishers should be freely distributed throughout the sections affected. Additional watchman service should be maintained.

Chemical Extinguisher.

S-8925. Fire occurred in stock room in power plant of mill. Watchman discovered and extinguished fire with a chemical extinguisher before fire was of sufficient magnitude to operate sprinklers.

Concealed Space.

H-4462. Fire occurred in the hollow ceiling of ninth floor, burning over a space of about ten by ten feet. Heat was so confined in joist channels of hollow ceiling that neither sprinklers nor thermostats operated.

S-9198. Fire started in the ceiling of engine room, near belt enclosure, probably caused by employee dropping cigarette through crack in floor above. Sprinklers could not extinguish fire until same burned through ceiling. Three sprinklers then opened and held fire in check.

Construction.

H-4558. At the suggestion of the Underwriters the open joist ceiling over some tinning forges was protected by a corrugated iron ceiling six feet below the bottoms of the ceiling joists. This ceiling was thoroughly riveted and hung by special hangers from the joists. The space thus shut off was cemented at the edges where the iron ceiling touched the walls and was ventilated by flues in two corners of this dead space. Previously, the joists had been protected by strips of asbestos fastened to the bottom of the joists above the metal flues from the furnaces.

The room above the tinning room had plank floor on joists and was used to scour copper boilers, a mixture of one-half sulphuric acid and water being used for this purpose.

It is probable that the combination of sulphuric acid and heat from the chimney, which was only four inches thick at this point, had carbonized the joists and header at the chimney to a considerable degree. A spark from some source, probably the flue, ignited this charred wood. This fire may have smouldered for a good while in the concealed space between the corrugated iron ceiling and the floor, the smoke and heat being carried off by the four flues. When discovered by the watchman, it was still smouldering. He attempted to get at the space by tearing out part of the corrugated iron ceiling, but was only partially successful, and the use of chemical extinguishers failed to reach all of the fire. The fire department was summoned by telephone after watchman had fought fire for about two hours, and the floor was chopped away from above. Immediately the flames burned briskly and in a very short time the floor gave way on the side toward the chimney, carrying down with it two tanks 30 by 30 inches by 6 feet, containing the sulphuric acid mixture. The water tower was used and owner states that there were four feet of water in the basement in the morning. This water had a considerable acid reaction and caused a good deal of damage to stock and finished goods which it touched.

The dead space as described was undesirable construction. The contact of the woodwork with the four-inch thick wall of the chimney, especially where sulphuric acid was in use, constituted a distinct hazard. This chimney should be reconstructed with double walls with air space between and all woodwork properly insulated from it. Upon discovery of fire, watchmen should immediately send in alarm to fire department before attempting the extinguishment with private apparatus.

Fire Department.

S-9198. Fire department in trying to locate fire tore down a frame partition, breaking off one line of sprinkler piping. The gravity tank, only supply to sprinklers, was emptied through the broken piping and open sprinklers.

Fire Walls.

H-4669. Fire communicated from building in which it started to adjoining building through an unprotected opening in basement. **Had this been bricked up or protected by approved fire doors, fire would have been confined to the one building.**

Floor Openings.

H-4563. Fire occurred in a section of building used for the storage of baled hay. The hay burned with great intensity, and open stairways, belt holes, etc., contributed largely to the rapid spread of fire. Loss $23,000.

All vertical and horizontal openings should be fully protected with approved fire doors or stopped up with wired lath and plaster. Belt enclosures should be used.

H-4711. Poorly enclosed elevator wells were largely responsible for the extensive spread of fire in the east section of building. One of the fire doors in division wall at top floor was open and the other may have been partially so, and fire quickly communicated with top floor of west section, from this point reaching floor below by the way of a poorly enclosed elevator shaft.

The fire forcibly demonstrated that all vertical openings should be well protected and that none but standard automatic fire doors should be installed.

Gate Valve.

S-9282. Fire discovered at 2.45 A. M. Three sprinklers opened and extinguished fire. No one could be found who was familiar with sprinkler system or could locate gate valve to shut off sprinklers, and same were in operation until about 5 A. M. Fire occurred over coal pocket and loss was small.

Location of Building.

H-4550. Fire occurred in a small unsprinklered one-story frame, twelve by twelve feet, building used for the storage of varnish, lacquer, turpentine and shellac. Cause of fire unknown. This building was only

about nine inches from another unsprinklered shed used for the storage of excelsior and veneer. Fire department arrived promptly and confined fire to the varnish storehouse.

Such storehouses should be detached at least 50 feet from all buildings and should preferably be of fire resistive construction.

Obstruction to Distribution.

S-9286. One sprinkler opened, and although fire was in a barrel under a bench, controlled fire until watchman from other portion of plant, who heard rotary alarm, removed the smouldering barrel from building.

S-9335. Fire occurred in basement among some bales of horse-collar sweat-pads filled with jute. Cause, employee smoking during noon hour. Four sprinklers supplied by waterworks at 75 pounds pressure operated for about ten minutes. Fire department then shut them off and used a hose stream off and on for about an hour, it being necessary for firemen to open the bales in order to extinguish fire.

Private Brigade.

H-4519. Fire was fought and extinguished by private brigade using three hose streams from fire pumps, holding pressure at 80 pounds. **Commendable work.**

Private Protection.

H-4504. Fire was discovered by watchman. Factory was outside of public protection and fire burned itself out, there being no private protection.

H-4543. Fire occurred in a small frame shed built under a gravity tank supplying automatic sprinkler system and used for **mixing cement.** A spark from motor used to operate the mixer ignited benzine vapors, causing an explosion. This shed was not equipped with sprinklers and exposed the sprinklered buildings. Fire was controlled by standpipe hose streams.

This is one of many instances occurring within the past few months of fires starting near or under gravity tank supply to sprinkler systems, where if fire had gained any proportions before being extinguished, it would have seriously handicapped if not entirely placed the sprinkler protection out of service. Appliances for the quick extinguishment of fires should be installed. Approved chemical extinguishers are of great value.

S-9044. Fire occurred on wooden platform under gravity tank on roof, used for sprinkler equipment, caused by sparks from smoke stack.

S-9340. Fire was discovered Saturday at 6.20 P. M. in the wooden casing enclosing the gravity tank drop. This casing was about two feet square and extended from the ground to the bottom of the wooden tank. The ten-inch tank drop and steam line were wrapped with hair felt. At

the ground was a small low addition about two feet square enclosing the three-inch by-pass and gate valve used for filling the tank. The gate valve in the by-pass needed repairing and this was done by the mechanics the day before the fire, and to prevent same from freezing was covered with straw, but no cover placed on the box. Fire probably caused by sparks from a passing locomotive, which fell in this straw. The fire was discovered at the base of the casing by an outsider and public alarm given.

Before the department arrived the fire chief of plant who lives nearby was on the scene and chopped away about five feet of the casing above the ground, allowing the balance to drop down and away from the tank bottom. This was repeated two or three times, or until there was no danger of the fire reaching the tank.

There were no tie rods from the tank trestle to the tank drop; if there had been, the chances are the fire would have eaten its way up inside the casing and burned away the girders under the tank. Hose stream was used from 750 gallon pump at 60 pounds pressure, and it was claimed that this pressure could not be increased, as the gate valve in the three-inch by-pass or filling line to the tank had been left open, and when the casing fell from the tank drop, the wheel on the stem was broken off, so the excess water was going into the tank and overflowing same.

The casing about the drop was burned or torn away, also the felt wrapping washed away from the pipes for a considerable distance leaving same exposed to the weather, so the tank had to be emptied. This was done at 12.30 A. M. through private hydrant on the street. As it was necessary to drain tank, water was allowed to run until it stopped. This drained the other two tanks. The post indicator gate valve in the large tank line was then closed, the other two sprinkler tanks, 10,000 and 5,000 gallons capacity each, were filled as were the suction tanks, and system was left with water on.

S-9401. Gavity tank, primary water supply to sprinkler system, was out of service, leaving the automatic electrically-driven centrifugal pump the only supply available. One sprinkler opened and pump operated intermittently for about twenty minutes, extinguishing fire.

S-9509. Fire occurred on roof in pressure tank house, frame construction, metal clad, space between sheathing formed by studding filled with shavings; ice-box construction. Fire occurred in this shaving insulation from unknown cause.

Tank house should preferably be constructed of fire-resistive material, as a fire occurring nearby endangers the entire automatic sprinkler equipment.

Public Protection.

H-4712. Hydrant nearest to mill was frozen. This was not discovered until hose connection had been made. The second hydrant was 450 feet distant, and as hose wagon carried only 900 feet of hose, only two streams could be used until an additional supply was secured from a substation about a quarter of a mile distant. Loss total.

Standpipe and Hose.

H-4461. Building was equipped with standpipe and hose. Employee discovered fire at very early stage, and had not the city water been shut off to permit installing a new connection, fire could easily have been extinguished. Loss total.

S-9207. Fire was caused by a girl dropping a lighted taper into box of cloth clippings. Employees at once used a line of small hose connected to sprinkler equipment, extinguishing fire before sprinklers opened. Considerable water damage resulted, owing to employees leaving gate valve open, some time being lost before valve could be closed after fire was extinguished.

When using hose streams from standpipe for extinguishing incipient fires, one employee should be stationed at valve to shut same as soon as fire is extinguished, to avoid unnecessary water damage.

Water Pails.

S-9151. Water pails were used, extinguishing fire in spinning frame before it had time to spread and before sprinklers opened. No loss.

Annual Summary

Statistics of Fires in Properties Having Automatic Sprinkler Protection

Note.—These tabulations are made at the close of each fiscal year, with the object of furnishing a basis upon which the virtue of the automatic sprinkler as an extinguishing agent can be estimated.

Section I is devoted to fires in which the behavior of sprinklers was, for the reasons given, unsatisfactory.

Section II is a statistical record of all reports of sprinkler fires in the files of the Association upon which the information obtained is sufficiently complete for statistical purposes.

SECTION I.

Unsatisfactory Sprinkler Fires.

Since publication of the last annual summary 42 fires, or about three per cent of those reported for the year, show failing of sprinklers to hold fire in check. Individual notes on these fires are given below, following which are tables showing causes of their sprinkler failures as compared to those of sprinkler failures reported in the statistics of previous years:—

May 5, 1908. 8955. Cooperage. Fire occurred in dry house and dry kiln due to over-heating. Owing to the severe obstruction to distribution, water from sprinklers was unable to extinguish fire, and fire was fought with hose streams for nearly eight hours.

March 15, 1909. 8432. Cotton Waste Mill. Brick building, joist construction, floors poorly constructed and full of cracks, allowing fire to quickly spread throughout building. Sprinkler equipment was old standard and defective, and failed to check fire.

March 18, 1909. 8438. Oilcloth Factory. Fire occurred in room used for cork grinding, and spread through holes in ceiling to roof house. Roof house was frame, metal clad, with wooden sheathing at ceiling and walls. Unsatisfactory work of sprinklers in the roof house due to sheathed finish. Sprinklers helped hold fire in check on second floor.

March 22, 1909. 8437. Rubber Works. Water from sprinklers on kettle of burning rubber cement caused the blazing liquid to flow over floor. Severe hazard.

April 3, 1909. 8433. Saw and Planing Mill. Fire started in a battery of dry kilns, frame joisted construction. Sprinklers did good work, but were at a disadvantage, as several heads were plugged with lead. There was also severe obstruction to distribution from the contents of dry kiln.

April 8, 1909. 8436. Woodworker. Sprinkler equipment, as far as is known, was entirely out of commission, steamer connections to sprinkler equipment being plugged, and gravity tank drained. Incendiary fire.

April 9, 1909. 8440. Woodworker. Fire occurred in a large frame, joist constructed dry kiln. Sprinklers were of high test, 286 degrees, and badly obstructed by lumber. Blower system spread fire rapidly, opening a large number of sprinklers. Water supply for fire pump was limited, and private reservoir was exhausted before fire was extinguished.

April 13, 1909. 8431. Machine Works. Fire started in an unsprinklered building, rapidly spreading to sprinklered buildings on account of the high wind. Rotary pump was out of service, and 1,000 gallon pump broke down shortly after start of fire. Other water supplies were deficient, and fire gained great headway.

April 24, 1909. 8441. Knitting Mill, Cop Yarn. Water from sprinklers was badly obstructed from the stockings in racks built to ceiling, and well filled. This caused an excessive number of sprinklers to open, depleting water supply. Floor collapsed later on account of the excessive weight of the water-soaked goods, putting the sprinkler system out of service.

April 28, 1909. 8435. Tannery. Unsatisfactory work of sprinklers due to the large, dry pipe systems in poorly constructed buildings. Care of fire appliances was neglected, and the floors had settled, throwing the sprinkler piping out of line in many places. This caused continual leaks in the dry systems, and it is unknown whether some of the gate valves were closed at time of fire or not.

May 1, 1909. 8302. Oilcloth and Linoleum Works. Fire occurred in drying building containing freshly coated linoleum hanging in long festoons from drying racks at roof. This proved a very severe hazard, with severe obstruction to distribution to the water discharged from sprinklers.

May 14, 1909. 8963. Cotton Waste Mill. Old and defective sprinkler heads under light water pressure allowed fire to extend to all three floors of the building through belt holes and unprotected stairways. Water supply was from a 5,000 gravity tank, which was soon exhausted.

May 15, 1909. 8434. Shoe Factory. Fire had evidently been burning some time before discovery, the thermostatic system failing to give the alarm. Fire occurred on third floor near elevator, and rapidly spread throughout the building. Sprinklers opened properly and valves were found open. Unsatisfactory work was due to the defective alarm system and sprinkler equipment.

June 9, 1909. 8857. Cotton Mill. Fire occurred in picker room in the conveyor system. Post indicator valve controlling supply to sprinklers in picker building was defective and registered open, although valve was closed.

June 10, 1909. 8439. Paper Mill. Building was basement and two stories high of mill construction. Elevators and stairs, of which there were several, were all open. Cause of fire unknown. Sprinkler system was limited, and did not cover boiler house and other important sections. Shortly before fire gravity tank was found empty and fire pump out of service, but it is stated that tank had been filled. Rotary fire pump was, however, of no value and was not used. Defective equipment and unsprinklered portions.

July 20, 1909. 8858. Cotton Mill. Owing to repairs being made to sprinkler system, water was shut off from both water supplies. During this period fire broke out in the dry room and spread rapidly, being finally controlled by hose streams.

July 23, 1909. 8853. Cordage Works. Building was frame joist construction, fairly well cut off from brick mill adjoining, but not cut off from the rope-walk section. Buildings were equipped with a large dry-pipe system with small pipe sizes. A large amount of loose stock accounted for the quick spread of fire. Defective fire-wall allowed fire to pass unnoticed and gain considerable headway in section not thoroughly protected with sprinklers and where water pressure had been reduced by excessive draughting in both sections. Defective equipment.

August 5, 1909. 8851. Paper Mill. Mill was shut down undergoing repairs, but several men were working in building at time of fire. Fire department responded, and soon had six or eight streams on fire. Every sprinkler in the room was found open. Obstruction to distribution was not severe and no reason is given for the failure of these sprinklers to control fire in its incipiency. It is conjectured that water was shut off at an early stage of the fire and turned on again later, allowing fire to spread and open an excessive number of heads while system was out of service.

August 12, 1909. 8854. Manufacturing Viscoloid (Pyroxylin Plastic). Severe exposure fire from the burning viscoloid scrap storehouse proved too severe an exposure for the sprinklered storehouse.

August 27, 1909. 8850. Rubber Hose and Tire Works. Fire occurred in cement mixing building from unknown cause. Gasolene in the mixer exploded, wrecking the mixing house and sprinkler system.

September 16, 1909. 8859. Flour Mill. Severe dust explosion occurred on the fourth floor of the main flour mill building. This was not of sufficient force to wreck the building or sprinkler system. It is stated that the sprinkler system worked all right, although there is a question as to whether or no the explosion crippled the sprinkler system. The dust explosion quickly spread fire throughout building, overtaxing sprinkler equipment.

October 10, 1909. 9915. Woodworker. Fire occurred in boiler and engine room, spreading into belt enclosure, where water from sprinklers was obstructed. Several sprinklers failed to open, and fire spread throughout beltway.

October 12, 1909. 9056. Woolen Mill, Full Process. Fire occurred in unsprinklered boiler house, exposing the main mill buildings. Primary water supply was from a 13,000 gallon gravity tank; secondary supply from a rotary pump located in the unsprinklered boiler house. This could not be started, and the severe exposure destroyed the main mill buildings.

October 14, 1909. 9060. Manufacturing Pyroxylin Plastic Articles. Fire occurred in the open stock of celluloid, rapidly spreading over shelves and benches nearby, also into the dipping room in attic. This opened a considerable number of sprinklers, the hazard proving too severe for the sprinklers as installed.

October 22, 1909. 9068. Oilcloth and Linoleum Works. Fire occurred in the seasoning room occupied for seasoning and backing linoleum. The hazard and obstruction to distribution to water discharged from sprinklers was severe, and fire was controlled by private fire department after about a nine hours' fight.

November, 1909. 9366. Woolen Mill. Owing to old and defective equipment, together with floor openings, fire spread beyond control of sprinklers.

November 8, 1909. 9916. Shoddy Mill. Fire occurred in the enclosed bed driers equipped with high test sprinkler heads. These were probably slow in operation, and fire soon broke out of dryer, opening 60 to 70 heads in all. Primary water supply was of light pressure and limited. Rotary pump was used to supply hose streams as well as pumping into sprinkler system.

November 9, 1909. 9917. Worsted Mill. Fire occurred in the basement of picker building, and spread into unsprinklered elevator well, passing into attic and other sections of building and dyehouse. Equipment in building was deficient, with many unsprinklered sections. Fire was finally controlled by the use of hose streams.

November 20, 1909. 9918. Furniture Factory. Sprinklers had been shut off in shavings vault owing to danger of freezing, and were of no service in controlling fire.

November 26, 1909. 9280. Cotton Mill Warehouse. Fire occurred in section of warehouse containing about seven hundred and fifty bales of of cotton, burning under and between bales, where water from sprinklers could not reach them. Sprinklers were, however, of service in protecting roof.

December 1, 1909. 9926. Knitting Mill, Full Process. Boiler explosion wrecked boiler house, putting the sprinkler system out of commission in various sections of the buildings.

December 2, 1909. 9919. Machine Works. Sprinklers in building in which fire occurred had been shut off on account of the cold weather and danger of freezing, and were of no value in controlling fire.

December 3, 1909. 9920. Cotton Mill. Fire occurred in dyehouse, opening three sprinklers. After sprinklers had been in operation for about fifteen minutes employee closed the inside valve, cutting off supply to all sprinklers in building, and went to repair shop for new sprinkler heads. During his absence fire started up again, opening one hundred and eighty-four additional sprinklers. Valve was immediately opened, but sprinklers were probably of limited service in extinguishing fire on account of large number opened.

December 8, 1909. 9921. Jute Bagging Works. Fire occurred in picker room, being extinguished by sprinklers, chemical extinguishers and hose stream, sprinklers then being shut off. About this time fire was discovered on floor above. Sprinklers were again put in operation, but were of little assistance, on account of the large number of sprinklers opened during the time that the system was out of service.

December 15, 1909. 9409. Paper Stock Warehouse. Warehouse was equipped with sprinklers, many of which opened. The system, however, was shut off at time of fire, owing to danger of freezing.

January 25, 1910. 9581. Paper Mill. Fire occurred between two pairs of driers, spreading through ventilator boxing to the floor above. Sprinkler pipe in hood over machines was found plugged after fire, allowing fire to rapidly spread and open a considerable number of heads. Water supply was deficient, and pump was used to supply hose streams instead of being used on sprinkler system.

January 30, 1910. 9474. Metal Worker. Water was shut off at time of fire owing to danger of freezing.

February 7, 1910. 9488. Woolen Mill. Main mill building was only partially equipped with sprinklers, fire starting in unequipped portion. Sprinklers in equipped section held fire in check until water supply was depleted.

February 10, 1910. 9495. Broom Factory. Water was shut off sprinkler system on account of a defective dry system.

February 12, 1910. 9499. Clothing Factory. Owing to severe obstruction to distribution from a long cutting table, sprinklers were unable to extinguish fire in its incipiency, the heat opening a large number of heads, exhausting gravity tank, the only water supply.

March 6, 1910. 9593. Carriage Factory. Buildings were mainly of large area, frame construction, occupied for woodworking, etc. System was old and defective, with deficient water supply. There were also many unsprinklered parts adjoining and communicating with the sprinklered sections. Fire rapidly spread, owing to the light water pressure, and soon enveloped nearly all of the mill buildings.

March 10, 1910. 9486. Manufacturing Storage Batteries. Sprinkler system shut off at time of fire, to allow the extension of same to cover new addition. No precaution was taken to supply means for the quick extinguishment of small fires. Loss to building and contents was practically total.

Summary of Unsatisfactory Sprinkler Fires.

(Sprinkler failures of current year compared to those of previous years.)

	1910.		1897-1910, Inc.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Water shut off sprinklers	10	24	121	23
Generally defective equipment and unsprinklered portions	12	29	122	23
Defective water supply or supplies	3	7	60	11
Exposure or conflagration	2	5	51	10
Hazard of occupancy too severe for average sprinkler equipment	4	10	31	6
Obstruction to distribution	4	10	27	5
Faulty building construction, concealed space, vertical openings, etc.	1	2	24	5
Explosion crippled sprinkler system	3	7	22	4
Sprinkler system crippled due to freezing	..	..	14	3
Slow operation of dry system or defective dry valve	..	..	11	2
Slow or defective operation of high test heads	1	2	9	2
Miscellaneous	1	2	15	3
Not classified	1	2	18	3
Total	42		525	

Special Classification of Fires in which Failure was Due to Water Being Shut Off Sprinklers.

(Comparative Tables.)

	1910.	1897-1910, Inc.
	No. of Fires.	No. of Fires.
Water shut off for unknown reason, neglect or carelessness	0	52
Water shut off before fire was out or fire rekindled	2	22
Water shut off due to accident or repairs	2	17
Water shut off to prevent freezing	4	16
Water shut off, probably incendiary	0	7
Water shut off, leaky dry system	1	3
Water shut off, miscellaneous	0	3
Water shut off, defective gate valve	1	1
Total water shut off sprinklers	10	121

SECTION II.

Annual Revision of Sprinkler Fire Tables.

In the following ten tables is given a summary of fires occurring in properties equipped with sprinklers. Number of fires reported during year, 1,131, not including 263 fires where no sprinklers were opened. Total number of fires on record for years 1897 to 1910, 8,347, being a fourteen years' record.

These tables constitute a complete up-to-date revision of similar tables previously published. In addition to the fires, of which a complete record has been obtained, and which are indexed, many reports have been received on fires of which the record is incomplete. Such fires can be used in some of the tables but not in others, and are not included in the above total.

Table No. 1.

Time of Day.

	No. of Fires. 1910.	No. of Fires. 1897-1910 Inc.	Per Cent. of No. with Data Given. 1910.	Per Cent. of No. with Data Given. 1897-1910 Inc.
6 a. m. to 6 p. m.	498	4721	44	59
6 p. m. to 6 a. m.	624	3383	56	41
Total with data given	1122	8104		
No data	9	243		
Total	1131	8347		

Table No. 2.

How Discovered.

	No. of Fires. 1910.	No. of Fires. 1897-1910 Inc.	Per Cent. of No. with Data Given. 1910.	Per Cent. of No. with Data Given. 1897-1910 Inc.
Employee	722	4964	64.46	62.12
Watchman	155	1289	13.84	16.13
Sprinkler Alarm	152	966	13.57	12.09
Outsider	50	455	4.46	5.69
Thermostats	36	304	2.32	3.80
Automatic Pump	2	9	.18	.11
Supervisory System	3	3	.27	.04
Total with data given	1120	7990		
No data	11	357		
Total	1131	8347		

Table No. 3.

Efficiency of Alarm Service, 1910.

	Satisfactory. No. of Fires.	Satisfactory. Per Cent.	Failure. No. of Fires.	Failure. Per Cent.	Total.
Watchman alone	85	82	19	18	104
Sprinkler alarm alone	95	90	10	10	105
Thermostats alone	14	78	4	22	18

	Watchman. Satisfactory.	Watchman. Failure.	Sprinkler Alarm. Satisfactory.	Sprinkler Alarm. Failure.	Thermostat. Satisfactory.	Thermostat. Failure.	Supervisory. Satisfactory.	Supervisory. Failure.	Total
Watchman and Sprinkler Alarm	66	44*	103	7	..	..	..	..	110
Watchman and Thermostats	..	..	..	..	..	..	..	..	
Sprinkler Alarm and Thermostats	..	..	34	1	23	12	..	..	35
Watchman, Sprinkler Alarm and Thermostats	2	2*	4	..	4	..	..	..	4
Sprinkler Alarm and Supervisory System	..	..	4	..	..	..	4	..	4

Efficiency of Alarm Service, 1897–1910, Inclusive.

	Satisfactory. No. of Fires.	Satisfactory. Per Cent.	Failure. No. of Fires.	Failure. Per Cent.	Total.
Watchman alone	785	91	81	9	866
Sprinkler alarm alone	614	92	52	8	666
Thermostats alone	136	78	37	22	173

	Watchman. Satisfactory.	Watchman. Failure.	Sprinkler Alarm. Satisfactory.	Sprinkler Alarm. Failure.	Thermostat. Satisfactory.	Thermostat. Failure.	Supervisory. Satisfactory.	Supervisory. Failure.	Total.
Watchman and Sprinkler Alarm	478	269*	638	109	..	..	..	..	747
Watchman and Thermostats	7	3*	..	..	9	1	..	..	10
Sprinkler Alarm and Thermostats	..	..	231	18	181	68	..	..	249
Watchman, Sprinkler Alarm and Thermostats	27	28*	49	6	37	18	..	..	55
Sprinkler Alarm and Supervisory System	..	..	4	..	..	..	4	..	4

*These include fires where sprinkler alarm or thermostats notified the watchman.

Note.—These tables do not include fires where alarm service does or does not operate properly if fire is at once discovered by employee, the alarm service having no bearing on such fires one way or the other.

Table No. 4.

Number of Sprinklers Operating.

	No. of Fires. 1910.	No. of Fires. 1897-1910 Inc.	Per Cent. of Whole. 1910.	Per Cent. of Whole. 1897-1910 Inc.
1	405	2965	33.30	29.95
2	180	1533	14.80	15.48
3	126	1024	10.36	10.34
4	93	720	7.64	7.27
5	61	503	5.01	5.08
6	44	406	3.62	4.10
7	33	267	2.71	2.70
8	30	260	2.47	2.62
9	28	171	2.30	1.73
10	23	164	1.89	1.66
11	24	146	1.97	1.47
12	18	145	1.48	1.46
13	7	86	.58	.87
14	13	103	.85	1.04
15	6	73	.49	.74
16 to 20	35	288	2.87	2.91
21 to 25	15	168	1.23	1.69
26 to 30	19	128	1.56	1.28
31 to 35	7	76	.58	.77
36 to 40	4	58	.32	.59
41 to 50	11	95	.90	.96
51 to 75	14	130	1.15	1.31
76 to 100	8	63	.66	.64
Over 100 (including large number or all)	12	328	.99	3.31
Total with data given	1216	9900		
Water shut off sprinklers	8	101		
No data	5	170		
Total	1229	10171		

Table No. 5.

Number of Sprinklers Operating.

	No. of Fires. 1897-1910 Inc.	Per Cent. of Whole. 1897-1910 Inc.
1	2965	29.95
2 or less	4498	45.43
3 or less	5522	55.77
4 or less	6242	63.05
5 or less	6745	68.03
6 or less	7151	72.23
7 or less	7418	74.93
8 or less	7678	77.55
9 or less	7849	79.28
10 or less	8013	80.94
11 or less	8159	82.31
12 or less	8304	83.88

Table No. 5—Continued.

Number of Sprinklers Operating.

	No. of Fires, 1897-1910 Inc.	Per Cent. of Whole. 1897-1910 Inc.
13 or less	8390	84.75
14 or less	8493	85.79
15 or less	8566	86.53
20 or less	8854	89.53
25 or less	9022	91.13
30 or less	9150	92.42
35 or less	9226	93.19
40 or less	9284	93.78
50 or less	9379	94.74
75 or less	9509	96.05
100 or less	9572	96.69
Over 100 (including large number or all)	328	3.31
Total with data given	9900	
Water shut off sprinklers	101	
No data	170	
Total	10171	

Table No. 6.

Sprinklers Opened on Wet or Dry Systems.

	No. of Fires. 1910.	No. of Fires. 1897-1910 Inc.	Per Cent. of No. with Data Given. 1910	Per Cent. of No. with Data Given. 1897-1910 Inc.
Wet system	905	6320	81	79
Dry system	213	1682	19	21
Total with data given	1118	8002		
Water shut off system	8	101		
No data	5	244		
Total	1131	8347		

Table No. 7.

Primary Water Supplies to Sprinklers Opened.

	No. of Fires. 1910.	No. of Fires. 1897-1910 Inc.	Per Cent. of No. with Data Given. 1910.	Per Cent. of No. with Data Given. 1897-1910 Inc.
Water Works	605	3814	54.11	47.66
Gravity Tank	275	2540	24.60	31.74
Pressure Tank	166	1152	14.87	14.38
Automatic Pump	72	495	6.44	6.19
Automatic Electric Pump	..	1		.01
Steamer Connection	..	1		.01
Total with data given	1118	8003		
Water shut off system	8	101		
No data	5	243		
Total	1131	8347		

Table No. 8.

Effect of Sprinklers.

	No. of Fires. 1910.	No. of Fires. 1897-1910 Inc.	Per Cent. of No. with Data Given. 1910.	Per Cent. of No. with Data Given. 1897-1910 Inc.
Practically or entirely extinguished fire	744	6535	60.54	64.25
Held fire in check	443	3111	36.05	30.59
Total successful	1187	9646	96.59	94.84
Unsatisfactory	42	525	3.42	5.16
Total	1229	10171		

Table No. 9.

Showing Effect of Sprinklers by Class of Occupancy.

	Extinguished Fire.		Held Fire in Check.		Total Satisfactory.		Unsatisfactory.		Total No. of Fires.
	No.	%	No.	%	No.	%	No.	%	
Agricultural Implements	32	67	15	31	47	98	1	2	48
Automobile and Bicycle Factories	22	63	11	31	33	94	2	6	35
Bakeries	15	79	4	21	19	100	..	..	19
Basket	3	100	..	..	3	100	..	..	3
Bolt, Nut and Screw Works	5	83	1	17	6	100	..	..	6
Boot and Shoe Factories	241	78	57	18	298	96	11	4	309
Bottling	1	100	..	..	1	100	..	..	1
Breweries	2	67	1	33	3	100	..	..	3
Broom	3	60	1	20	4	80	1	20	5
Brush	4	80	1	20	5	100	..	..	5
Candle	3	60	2	40	5	100	..	..	5
Candy Factories	22	71	8	36	30	97	1	3	31
Canning	4	66	1	17	5	83	1	17	6
Car House	10	42	9	37	19	79	5	21	24
Car Works	35	69	15	29	50	98	1	2	51
Carpet Mills	68	62	39	35	107	97	3	3	110
Carriage Factories	51	66	21	27	72	93	5	7	77
Celluloid (Pyroxylin Plastic)	22	45	16	33	38	78	11	22	49
Cement and Plaster Works	1	50	..	..	1	50	1	50	2
Cereal Mills	14	67	3	14	17	81	4	19	21
Chemical and White Lead	24	63	12	32	36	95	2	5	38
Clothing Factories	144	80	31	17	175	97	5	3	180
Coffee and Spice Mills	16	67	8	33	24	100	..	..	24
Coffin Factories	16	73	5	23	21	95	1	5	22
Cork Factories	..	..	..	..	..	..	2	100	2
Cooperage	27	56	14	29	41	85	7	15	48
Cold Storage	1	50	1	50	2	100	..	..	2
Cordage	139	70	50	26	189	96	8	4	197
Cotton Ginnery	5	100	..	..	5	100	..	..	5
Cotton Mills	1843	60	1173	38	3016	98	44	1	3060
Cotton Mill Warehouses	46	41	52	47	98	88	13	12	111
Cotton Seed Oil Mills	17	53	9	28	26	81	6	19	32
Cutlery and Hardware	5	56	3	33	8	89	1	11	9
Department Stores	146	78	37	20	183	97	5	3	188

Table No. 9—Continued.

	Extinguished Fire.		Held Fire in Check.		Total Satisfactory.		Unsatisfactory.		Total No. of Fires.
	No.	%	No.	%	No.	%	No.	%	
Distilleries	4	100	..	..	4	100	..	..	4
Drug Houses	71	83	11	13	82	95	4	5	86
Dyeing and Bleaching	60	51	52	44	112	95	6	5	118
Electrical Appliances	56	83	11	16	67	99	1	1	68
Electric Light and Power Plants	2	50	1	25	3	75	1	25	4
Elevators, Grain	10	32	10	32	20	64	11	36	31
Excelsior Factories	7	78	2	22	9	100	..	..	9
Fertilizer Factories	8	57	4	29	12	86	2	14	14
Flax and Linen Mills	10	44	12	56	22	100	..	..	22
Flour and Grist Mills	19	54	11	31	30	86	5	14	35
Forge and Smithy	6	75	2	25	8	100	..	..	8
Foundries	49	53	38	41	87	95	5	5	92
Furniture Factories	183	62	79	27	262	89	32	11	294
Gas Works	1	100	..	..	1	100	..	..	1
Glass Works	15	79	2	10	17	90	2	10	19
Glove Works	2	100	..	..	2	100	..	..	2
Glue Factories	1	25	1	25	2	50	2	50	4
Harness and Fancy Leather	16	80	4	20	20	100	..	..	20
Hat, Fur	17	68	6	24	23	92	2	8	25
Hat, Straw	2	50	2	50	4	100	..	..	4
Ice Factories	1	100	..	..	1	100	..	..	1
Incandescent Lamp	7	78	2	22	9	100	..	..	9
Insulated Wire	14	70	6	30	20	100	..	..	20
Jewelry Factories	38	83	5	11	43	94	3	6	46
Knitting Mills, Cop Yarn	21	54	13	33	34	87	5	13	39
Knitting Mills, Full Process	257	66	114	29	371	95	21	5	392
Laundries	10	56	7	39	17	95	1	6	18
Lead Pencil	7	78	2	22	9	100	..	..	9
Linseed Oil	8	73	3	27	11	100	..	..	11
Machine Shops	78	68	33	38	111	96	5	4	116
Match Factories	31	74	8	19	39	93	3	7	42
Mattress Factories	86	76	25	22	111	98	2	2	113
Mercantile	214	76	60	22	274	98	7	2	281
Metal Workers	222	65	105	31	327	96	15	4	342
Miscellaneous	118	71	43	26	161	97	5	3	166
Morocco Leather	4	27	8	53	12	80	3	20	15
Moving Picture Theatres	2	67	1	33	3	100	..	..	3
Musical Instrument Factories	49	72	16	24	65	96	3	4	68
Oil Clothing Factories	4	57	3	43	7	100	..	..	7
Oilcloth and Linoleum Works	15	35	16	37	31	72	12	28	43
Oil Refinery	2	40	3	60	5	100	..	..	5
Packing House and Slaughter	12	75	4	25	16	100	..	..	16
Paint and Color Works	61	76	16	20	77	96	3	4	80
Paper Box and Papeterie	33	79	8	19	41	98	1	2	42
Paper Mills	121	57	69	32	190	89	24	11	214
Patent Leather	4	57	3	43	7	100	..	..	7
Picture Frame	21	66	7	22	28	88	4	12	32
Potteries	18	78	3	13	21	91	2	9	23
Printing and Lithographing	174	78	38	17	212	95	11	5	223
Pulp, Miscellaneous	5	42	5	42	10	84	2	17	12
Pulp, Soda	1	20	1	20	2	40	3	60	5
Pulp, Sulphite	10	45	7	32	17	77	5	23	22

	Extinguished Fire.		Held Fire in Check.		Total Satisfactory.		Unsatisfactory.		Total No. of Fires.
	No.	%	No.	%	No.	%	No.	%	
Restaurants	3	100	..	..	3	100	..	..	3
Rice Mills	..	..	1	100	1	100	..	..	1
Rolling, Wire and Tube Works	10	48	10	48	20	96	1	5	21
Roofing Mfg.	3	43	4	57	7	100	..	..	7
Rubber Works	37	55	26	38	63	93	5	7	68
Rubber Cloth	4	50	4	50	8	100	..	..	8
Rubber Reclaiming	3	60	1	20	4	80	1	20	5
Saw and Planing Mills	34	43	24	30	58	73	22	27	80
Shirt Factories	15	75	5	25	20	100	..	..	20
Shoddy Mills	59	56	34	32	93	89	12	11	105
Silk Mills	18	64	8	29	26	93	2	7	28
Skin Mills	2	67	1	33	3	100	..	..	3
Soap Mills	13	81	2	13	15	94	1	6	16
Stamping and Sheet Metal Works	19	56	11	32	30	88	4	12	34
Starch and Glucose Mills	6	55	1	9	7	64	4	36	11
Sugar Refining	4	67	2	33	6	100	..	..	6
Tanneries	15	56	8	30	23	85	4	15	27
Tenant Manufacturing	123	72	44	26	167	97	5	3	172
Theatre	16	80	3	15	19	95	1	5	20
Tobacco Factories	22	67	10	30	32	97	1	3	33
Varnish Works	2	67	..	..	2	67	1	33	3
Wall Paper Mfg.	5	63	1	13	6	75	2	25	8
Warehouses	33	79	8	19	41	98	1	2	42
Waste and Batting Mills	118	71	42	25	160	96	6	4	166
Weaving Mills	51	65	25	32	76	96	3	4	79
Whip Factories	3	100	..	..	3	100	..	..	3
Window Shade Mfg	3	75	..	..	3	75	1	25	4
Woodworkers, Class A*	56	53	33	31	89	84	17	16	106
Woodworkers, Class B*	42	41	50	49	92	90	10	10	102
Woodworkers, Class C*	77	62	41	33	118	94	7	6	125
Woodworkers, Class D*	36	53	24	35	60	88	8	12	68
Woodworkers, Class E*	29	59	18	37	47	96	2	4	49
Woodworkers, Class F*	13	59	6	27	19	86	3	14	22
Woodworkers, Miscellaneous	1	100	..	..	1	100	..	..	1
Woolen Mills	462	70	163	25	625	94	37	6	662
Woolen Mill Storehouses	12	71	4	24	16	94	1	6	17
Worsted Mills	12	33	15	42	27	75	9	25	36
Total Sprinkler Fires	6535	64	3111	30	9646	95	525	5	10171

*Note.— The Woodworkers are classed as follows:

Class A. Planing Mills; interior woodwork, builders supplies (including veneer works).

Class B. Box Factories. (Including cigar boxes.)

Class C. Miscellaneous Woodworkers. (Steam power) tenant woodworkers, (also woodworkers where there is a lack of detailed information as to class).

Class D. Sash, Door and Blind Factories.

Class E. Hard Wood Turning. (Wheels, pipes, novelties, bobbins, spools, etc., last and wood heel factories).

Class F. Pails and Woodenware. (Plates, wooden bowls, tubs, etc.).

Table No. 10.

Classification of Unsatisfactory Sprinkler Fires by Occupancies.

	Water shut off sprinklers.	Gen. defective equipment and unsprinklered portions.	Defective water supply or supplies.	Sprinkler system crippled due to freezing.	Slow operation of dry system or defective dry valve.	Slow or defective operation of high test heads.	Faulty building construction, concealed space, vertical openings.	Obstruction to distribution.	Hazard of occupancy too severe for average sprinkler equipment.	Explosion crippled sprinkler system.	Exposure or conflagration.	Miscellaneous.	Not classified.	Total.
Agricultural Implements	..	..	..	..	..	..	..	..	1	..	..	..	..	1
Automobile and Bicycle	1	..	..	..	..	..	..	..	..	..	1	..	..	2
Boot and Shoe Factories	..	1	2	..	..	1	..	..	..	2	5	..	..	11
Broom Factory	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Candy Factories	..	..	..	..	..	..	1	..	..	..	..	..	..	1
Canning Factories	..	..	..	..	..	..	..	..	..	..	1	..	..	1
Car Houses	1	1	1	..	1	..	..	1	..	..	..	..	..	5
Car Works	..	..	..	..	..	..	..	1	..	..	..	..	..	1
Carpet Mills	1	..	2	..	..	..	..	..	..	..	..	..	..	3
Carriage Factories	..	1	2	..	1	..	..	..	..	..	1	..	..	5
Celluloid, (Pyroxylin)	..	..	1	..	1	..	1	..	5	2	1	..	..	11
Cement and Plaster Works	..	..	..	..	1	..	..	..	..	..	..	..	..	1
Cereal Mills	..	2	1	..	..	..	..	..	..	1	..	..	..	4
Chemical and White Lead	1	..	..	..	..	..	..	..	..	1	..	..	..	2
Clothing Factories	2	..	1	..	..	..	1	1	..	..	..	..	..	5
Coffin Factories	..	..	..	1	..	..	..	..	..	..	..	..	..	1
Cork Factories	1	..	..	..	..	..	..	..	..	1	..	..	..	2
Cooperage	1	2	..	..	..	1	..	2	..	..	1	..	..	7
Cordage Works	2	3	..	..	..	..	..	2	..	..	..	..	1	8
Cotton Mills	17	9	6	..	..	1	4	1	..	..	..	2	4	44
Cotton Warehouses	6	..	2	..	..	..	1	2	1	..	..	1	..	13
Cotton Seed Oil Mills	1	2	1	..	..	..	..	..	..	..	..	2	..	6
Cutlery and Hardware	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Department Stores	2	1	..	..	..	..	..	..	..	..	2	..	..	5
Drug Houses	..	..	..	..	..	..	..	..	..	..	3	1	..	4
Dyeing and Bleaching	1	1	1	..	..	1	..	..	..	..	1	..	1	6
Electrical Appliances	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Electric Light and Power Plants	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Elevators	..	3	1	..	1	..	1	..	1	1	2	..	1	11
Fertilizer	1	..	..	..	1	..	..	..	..	..	..	..	..	2
Flour and Grist Mills	..	..	..	..	..	..	1	..	..	2	2	..	..	5
Foundries	4	..	1	..	..	..	..	..	..	..	..	..	..	5
Furniture Factories	6	8	2	3	..	..	1	5	5	..	2	..	..	32
Glass Works	..	..	..	..	..	..	..	..	..	..	..	..	2	2
Glue Factories	1	..	..	..	..	..	..	..	1	..	..	..	..	2
Hat, Fur	1	1	..	..	..	..	..	..	..	..	..	..	..	2
Jewelry Factories	2	1	..	..	..	..	..	..	..	..	..	..	..	3
Knitting, Cop Yarn	..	1	3	..	..	..	..	..	..	1	..	..	..	5
Knitting, Full Process	5	8	5	1	1	..	..	..	..	1	..	..	..	21
Laundries	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Machine Shops	3	1	..	..	..	..	..	..	..	1	..	..	..	5
Match Factories	2	..	..	..	..	..	..	..	1	..	..	..	..	3
Mattress Factories	1	1	..	..	..	..	..	..	..	..	..	..	..	2
Mercantile	3	1	..	1	..	..	..	..	..	..	2	..	..	7
Metal Workers	6	3	2	..	..	..	..	..	..	1	2	1	..	15
Miscellaneous	1	..	1	..	..	..	1	..	1	..	1	..	..	5
Morocco Leather	..	2	..	..	..	..	1	..	..	..	..	..	..	3

	Water shut off sprinklers.	Gen. defective equipment and unsprinklered portions.	Defective water supply or supplies.	Sprinkler system crippled due to freezing.	Slow operation of dry system or defective dry valve.	Slow or defective operation of high test heads.	Faulty building construction, concealed space, vertical openings.	Obstruction to distribution.	Hazard of occupancy too severe for average sprinkler equipment.	Explosion crippled sprinkler system.	Exposure or conflagration.	Miscellaneous.	Not classified.	Total.
Musical Instruments	..	2	..	..	..	..	..	..	..	..	1	..	..	3
Oilcloth and Linoleum Works	..	1	..	..	..	..	1	..	10	..	..	..	..	12
Paint and Color Works	1	..	1	..	..	..	1	..	..	..	..	..	..	3
Paper Box and Papeterie	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Paper Mills	3	11	3	2	..	..	..	..	..	..	2	1	2	24
Picture Frame	1	2	..	..	..	..	..	1	..	..	..	..	..	4
Potteries	..	..	..	1	..	..	..	..	..	1	..	..	..	2
Printing and Lithographing	4	3	1	..	..	..	..	..	..	..	3	..	..	11
Pulp, Miscellaneous	1	1	..	..	..	..	..	..	..	..	..	..	..	2
Pulp, Soda	2	1	..	..	..	..	..	..	..	..	..	..	..	3
Pulp, Sulphite	3	..	..	..	1	1	..	..	..	..	..	..	..	5
Rolling, Wire and Tube Works	..	..	..	..	..	..	..	..	..	..	..	..	1	1
Rubber Works	2	..	..	..	..	..	..	..	2	1	..	..	..	5
Rubber Reclaiming	..	..	..	..	..	..	1	..	..	..	..	..	..	1
Saw and Planing Mills	3	5	1	..	2	1	5	1	..	..	4	..	..	22
Shoddy Mills	4	1	5	..	..	2	..	..	..	..	..	..	..	12
Silk Mills	1	1	..	..	..	..	..	..	..	..	..	..	..	2
Soap Mills	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Stamping and Sheet Metal Works	..	2	1	..	..	..	..	..	..	..	1	..	..	4
Starch and Glucose Mills	..	..	..	..	..	..	..	..	1	3	..	..	..	4
Tanneries	..	..	..	2	..	..	..	..	..	..	1	..	1	4
Tenant Manufacturing	1	1	..	..	..	..	..	..	..	..	3	..	..	5
Theatre	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Tobacco Factories	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Varnish Works	..	..	..	..	..	..	..	..	1	..	..	..	..	1
Wall Paper Mfg	..	..	1	..	..	..	..	..	..	..	1	..	..	2
Warehouse	1	..	..	..	..	..	..	..	..	..	..	..	..	1
Waste and Batting Mills	..	3	1	..	..	..	..	1	..	..	..	1	..	6
Weaving Mills	1	..	1	1	..	..	..	..	..	..	..	..	..	3
Window Shade Mfg	..	..	..	..	..	..	..	..	1	..	..	..	..	1
Woodworkers, Class A*	4	6	..	..	..	..	..	5	..	1	1	..	..	17
Woodworkers, Class B*	2	3	..	..	..	..	..	1	..	2	2	..	..	10
Woodworkers, Class C*	1	3	1	..	..	..	..	2	..	..	..	..	..	7
Woodworkers, Class D*	..	5	..	..	..	..	..	..	..	..	2	1	..	8
Woodworkers, Class E*	1	..	..	..	1	..	..	..	..	..	..	..	..	2
Woodworkers, Class F*	2	..	..	..	..	..	..	1	..	..	..	..	..	3
Woolen Mills	3	13	7	1	..	1	3	..	..	..	3	3	3	37
Woolen Storehouses	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Worsted Mills	1	1	2	1	..	..	..	..	..	..	..	2	2	9
Total Unsatisfactory Fires	121	122	60	14	11	9	24	27	31	22	51	15	18	525

*See detailed classification of woodworkers as given in note under Table No. 9.

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